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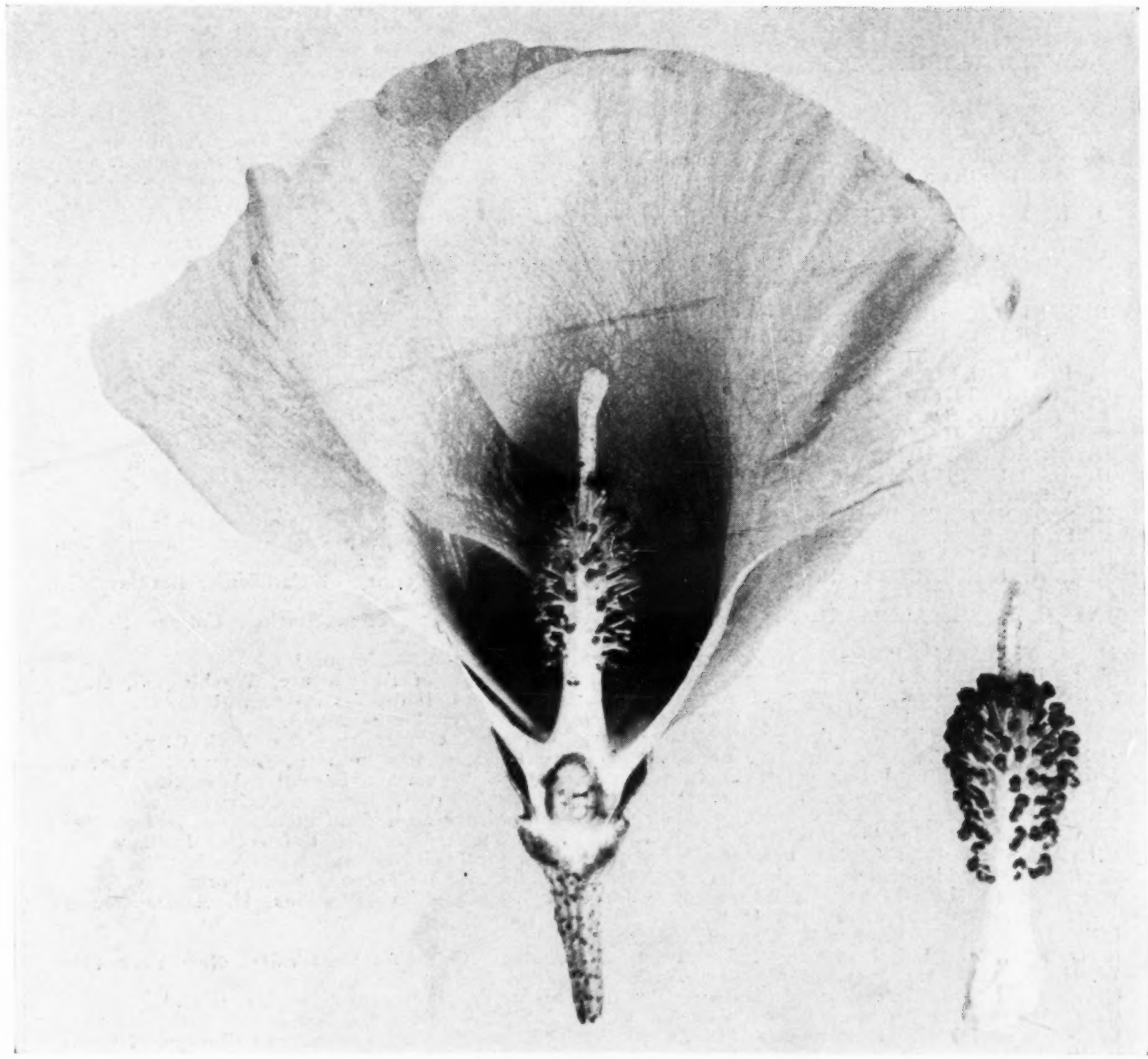

Section of a Cotton Flower

August, 1926 Vol. 17, No. 8

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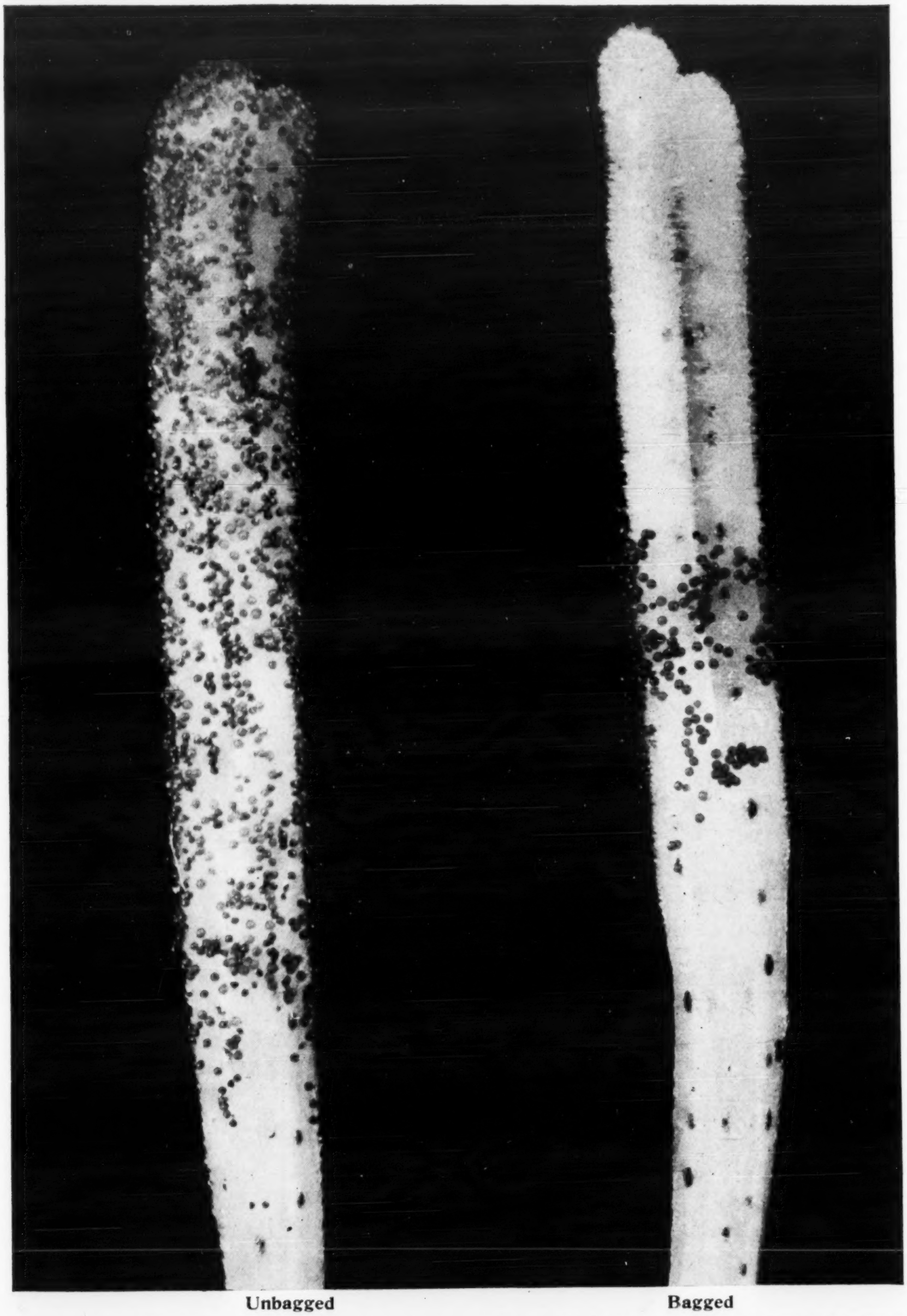


Unbagged Bagged

PISTILS OF BAGGED AND OF OPEN-POLLINATED COTTON FLOWERS

Frontispiece

Upper portion of the pistils, including the whole of the stigmas, dissected out from flowers of Pima cotton. In the bagged flower pollen is confined to the region which was surrounded by and just above the uppermost stamens. Pollen has been deposited here automatically, without the intervention of insects. The position of the lowest pollen grains corresponds to the apex of the sheath on which the stamens are borne. The upper half of the stigmatic surface is entirely free from pollen. On the pistil of the unbagged flower pollen-carrying insects have deposited the grains over the entire surface of the stigmas. Ten times natural size. (Photographed by H. F. Loomis.)

BAGGING COTTON FLOWERS

To Prevent Accidental Cross-Pollination

THOMAS H. KEARNEY and DOW D. PORTER,
Bureau of Plant Industry, U. S. Department of Agriculture

THE cotton flower is so constructed that cross-pollination by insects is easily effected[1]. Consequently, when two kinds of cotton are growing near each other, pure seed of either kind can be obtained only by excluding pollen-carrying insects from the flowers. Various devices are used by cotton breeders for this purpose. At the U. S. Field Station, Sacaton, Arizona, where breeding and genetic studies are carried on with Egyptian cotton, the practice is to enclose the flower buds in half-pound paper bags which are put on early in the morning, before the petals have begun to unfold. This method, although giving excellent results with Egyptian cottons, is less satisfactory with other types. Experience has shown that the flowers of Upland cotton are less likely to be shed if, instead of being bagged, the bud is prevented from opening by fastening around it a small rubber band or a spirally twisted piece of fine copper wire.

In attaching the bag, the sides are slit so that it can be placed astride the fruiting branch on which the bud is borne and closed tightly beneath the branch by means of a loop in a bit of insulated telephone wire (Figure 1). The bag now used in this work has a folded instead of a flat bottom and when it is placed in such a way that the bottom of the bag rests on the tip of the bud, the corolla is prevented from expanding inside the bag and the pistil is thus doubly protected against access of insects. Figure 1 shows a flower (marked with a tag) which had been enclosed in this manner. Although the stage of anthesis is past, the petals are still tightly enfolded, so that the old flower has the appearance of a bud.

The bags are allowed to remain in place until the afternoon of the day after anthesis, by which time the stigmas have ceased to be receptive and there is no further danger of accidental cross-fertilization. If the flowers have been bagged merely to obtain "selfed" seed, they are not tagged until the bags are removed. But in hybridization work and in experiments involving several different treatments, tags appropriately labelled are attached when the operation is performed. An experienced person can bag two hundred flowers for self-pollination in the course of an hour. The removal of the bags and attaching of the tags to the flower stalks can be performed with about equal rapidity.

Bagged Flowers Produce Less Seed

The large number of flowers which can be selfed in this manner compensates for the fact that bagged flowers, unless artificially pollinated, usually produce fewer seeds than flowers which are accessible to pollinating insects. In six comparisons, the data of which are given in the publication already cited (Table 31, p. 53) the mean number of seeds per boll from bagged flowers ranged from 71 to 91 per cent of the number from flowers that were not enclosed. There is occasionally a somewhat higher rate of shedding of the bolls from bagged flowers than from naturally pollinated flowers, although very good "setting" is frequently obtained in the former case. Thus at Sacaton in 1925 George J. Harrison bagged 100 flowers of Pima

FLOWERS PROTECTED FROM POLLEN-CARRYING INSECTS

Figure 1

A plant of Pima Egyptian cotton showing, on the upper fruiting branch, a newly bagged flower bud and, on the second branch below, a flower of the day before, from which the bag has just been removed and a tag attached to the flower stalk. The old flower looks like an unopened bud, the pressure of the sides of the bag having prevented the corolla from expanding. Double protection against the access of pollen carrying insects is thus obtained.

cotton, every one of which set a boll which reached maturity.

The less complete fertilization of the bagged flowers doubtless is due to the fact that under this condition pollen reaches only that part of the stigmas which is in contact with or immediately above the uppermost anthers (Figure 2). Examination of the pistils in flowers thus enclosed shows to what a narrow zone the pollen grains are restricted (Frontispiece). In unenclosed flowers, on the other hand, bees and other pollinating insects carry pollen to all parts of the stigmatic surface, soon after the corolla has expanded (Frontispiece). Bagged flowers are better fertilized when the whole surface of the stigmas is covered with pollen by hand than when pollen is confined to the basal portion, as was proved by the results of several experiments at Sacaton. In all of these experiments flowers pollinated on the whole surface of the stigmas yielded a higher mean number of seeds per boll than flowers pollinated at the base of the stigmas only. The difference in mean number of seeds ranged from 4 to 46 per cent and was significant in 6 of the 8 experiments.

White Bags More Efficient

A cotton plant in the height of the flowering season usually produces at least one flower per day. Since, in selfing work, the bags must be left on the flowers until the second afternoon, there will be bags enclosing flowers of two successive days on plants that are being selfed daily. In order to facilitate the removal of the bags from flowers of the day before without disturbing those put on the second day, it is necessary to use two lots of bags that can be distinguished readily. It was formerly the practice to alternate white and brown bags but indications were obtained that flowers enclosed in brown bags were not so well fertilized as those enclosed in white bags. Also it was thought possible that bags of the same color, but differing in the thickness and glaze of the paper, might give different results.

To test the efficiency of the different kinds of bags, an experiment was made at Sacaton in 1920, the results of which are given in Table I.

The seed yields from flowers bagged with the two kinds of white bags did not differ significantly, the difference having been only 2.5 times its probable error. On the other hand, the flowers enclosed in brown bags yielded only 75 per cent as many seeds as the flowers enclosed in light, unglazed white bags and only 70 per cent as many seeds as those enclosed in heavy, glazed white bags. The difference was 7 times its probable error in the first and 10 times its probable error in the second comparison. Since weight and texture of the bag seem to be unimportant, it is probable that the inferiority of the brown bag is due to its color which would cause greater absorption of heat and presumably raise the temperature of the enclosed flower to an unfavorable degree.

The results of this experiment having indicated that the use of colored bags leads to much waste of effort, selfing has since been done with white bags only, those used on alternate days being marked conspicuously to distinguish them from the plain bags used on the other days.

The Danger of Insect-Borne Pollen

Referring to the bagging method, it was stated, in the publication already cited, (p. 38) that "many thousands of flowers have been 'selfed' in this manner at Sacaton during the past eight years and none of the resulting progenies have given clear evidence of contamination from the access of foreign pollen. The efficacy of this method of excluding pollen transfer was tested by an experiment performed in 1915, in which 40 flower buds of Pima cotton were carefully emasculated and bagged in the ordinary manner the evening before the corolla was due to open. No artificial pollination was done, and none of the flowers devel-

oped a boll. The experiment was repeated in 1920, using 100 flowers, not one of which developed a boll."

The objection has been made by Dr. G. F. Freeman that the failure of any bolls to set from bagged flowers that have been emasculated but not pollinated is not conclusive proof that insects do not bring pollen to the stigmas of bagged flowers, because, if only a few grains of pollen are thus introduced, there would not be fertilization of a sufficient number of ovules to insure setting of the bolls. On the other hand, in the case of bagged flowers which have not been emasculated or which have been emasculated and artificially pollinated, setting of the bolls would be insured and any ovules fertilized by foreign pollen introduced by insects would have a chance to develop into seeds.

Insects commonly found in cotton flowers at Sacaton are shown in Figure 3. Bees and wasps (rows 4 to 7) which are the most efficient carriers of pollen, are of course excluded from bagged flowers but it is possible that small beetles, such as *Notoxus calcaratus* (row 3, center) and *Conotelus stenoides* occasionally enter the flowers thus enclosed and deposit a few grains of pollen upon the stigmas. It has been observed that the Conotelus sometimes enters an imperfect bud during the night or early morning before the corolla has expanded at the tip, but the structure of this insect is such that it probably rarely conveys pollen. Evidence has been presented recently[2] that smaller insects, thrips, can enter bagged flowers and effect cross-pollination, unless the bags are closed very tightly.

In seeking to ascertain how effectively foreign pollen is excluded from bagged flowers, plants of Pima Egyptian cotton were planted in 1924 at intervals in the rows of a plot of Acala Upland cotton and the isolated Pima plants were "staggered" in the alternate rows. The arrangement was such that each Pima plant was separated by 24 plants of Acala from the nearest Pima plant in the same row and by 12 plants of Acala from the nearest Pima plant in the adjacent rows. This method of planting was adopted in order to secure the greatest possible degree of exposure of the Pima flowers to cross-pollination by Acala pollen. The first generation hybrids between Egyptian and Upland cottons being conspicuously different from either parent, the resulting cross-fertilization, if any, could be readily detected in the offspring from bagged flowers of the Pima plants.

Flowers on the isolated Pima plants were treated as follows:

A. Bagged as in ordinary selfing work.

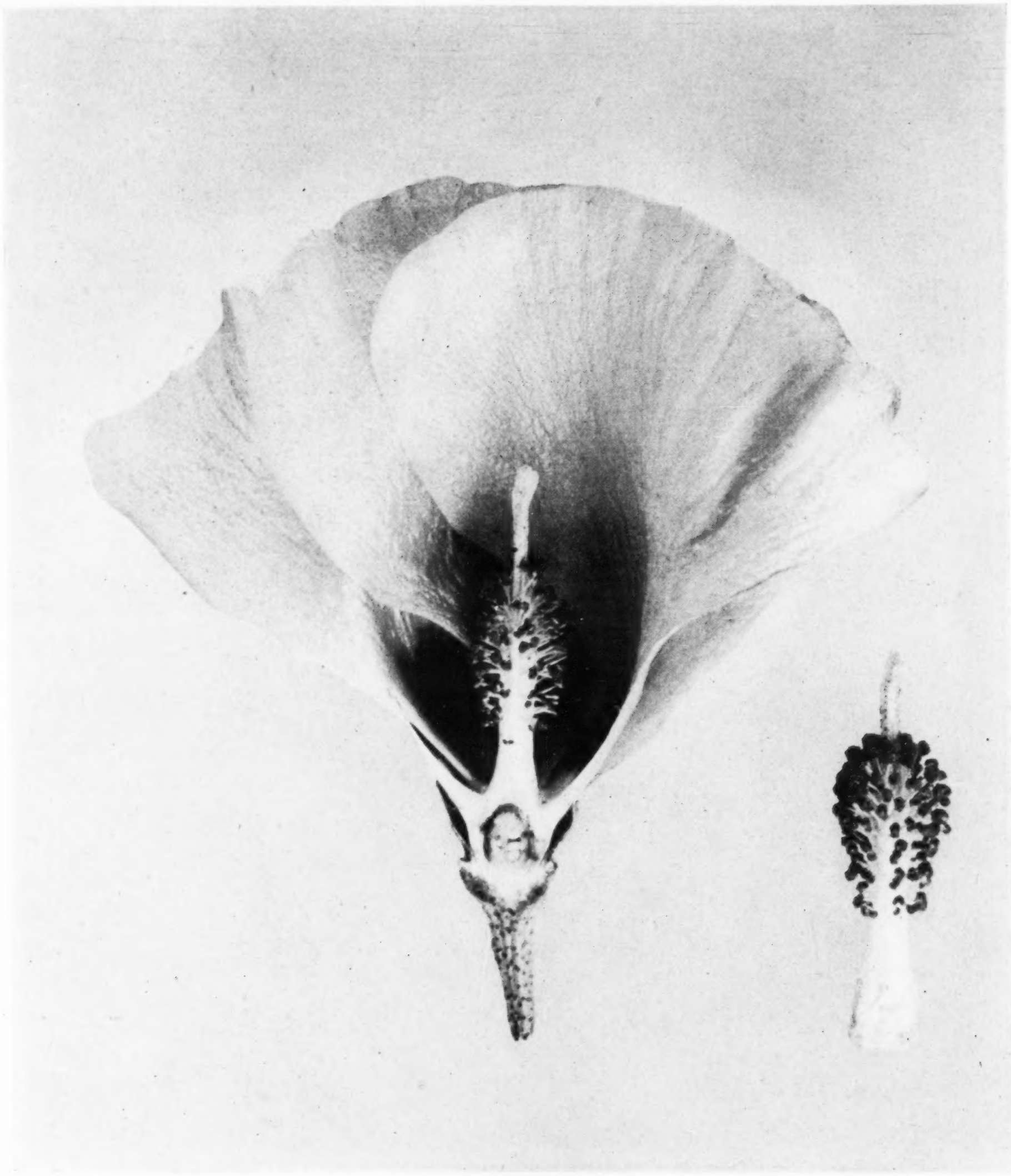
B. Bagged extra tight.

C. Not bagged, left to natural pollination.

Equal numbers of flowers received each treatment on each day of the experiment, which lasted throughout the month of August.

The three lots of seed thus obtained were planted in 1925. Although the number of seeds planted was practically the same for all treatments, very unequal numbers of plants survived, doubtless because of variation in the soil of the experimental plot. As soon as the plants were large enough to identify the hybrids with certainty, counts were made of the latter. The resulting data are given in Table II.

There were no hybrids in the progenies of seed from bagged flowers, whether the bagging was done as in the course of ordinary selfing work at Sacaton (treatment A) or with extra precaution to close the bags tightly (treatment B). The significance of this finding is greatly diminished, however, by the fact that only 3 hybrids, constituting 1.7 per cent of the population, were found in the progeny of open-pollinated flowers (treatment C) although the location of the plants on which these flowers were borne favored a maximum degree of cross-pollination. It is of interest that in an experiment with Pima plants isolated in a plot of Acala cotton at Sacaton in 1920, seed



COTTON FLOWER IN SECTION

Figure 2

Vertical section of a flower of Pima Egyptian cotton. As is the case in most members of the Mallow Family, to which cotton belongs, the pistil is partly enclosed in a sheath on which are borne the numerous stamens, which are bright yellow but appear black in the picture. Pollen grains deposited on any part of the pistil above the sheath can effect fertilization of the ovules, which are the small white objects seen exposed in the sectioned ovary at the base of the flower. The ovules, after fertilization, develop into seeds.

CARRIERS OF COTTON POLLEN

Figure 3

Insects commonly found in cotton flowers at Sacaton, Arizona.
Row 1 (top): Bugs (Hemiptera)
Rows 2 and 3: Beetles (Coleoptera)
Rows 4 to 7: Bees and wasps (Hymenoptera)

from the open-pollinated flowers yielded 12 per cent of hybrids[3].

In the absence of precise information as to the number and behavior of pollinating insects in the two seasons, no explanation can be given of the much lower degree of cross-fertilization in 1924 than in 1920. The interest attaching to so large a seasonal difference under experimental conditions that were practically the same in both years, warrants publication of the results of the 1924 experiment although they afford no conclusive evidence as to the frequency of accidental cross-fertilization in bagged flowers.

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1. KEARNEY, T. H. Self-fertilization and cross-fertilization in Pima Cotton. *U. S. Dept. Agric. Bul.* 1134 (1923) p. 12.

2. ANNAND, P. N. Thysanoptera and the pollination of flowers. *Am. Nat.* 60:177-182. 1926.

3. U. S. *Dept. Agric. Bul.* 1134, p. 9, Table V.

TABLE I—Relative efficiency of different kinds of bags as indicated by the mean number of seeds from each 100 flowers bagged

Kind of bag	*Weight of bag (grams)*	*Number of flowers treated*	*Mean number of seeds per 100 flowers bagged*
White, unglazed	2.5	249	1076±25
White, heavily glazed	3.3	235	1160±22
Brown, slightly glazed	3.0	240	811±27

TABLE II—Numbers and percentages of hybrids in plantings of the seeds from bagged and open-pollinated flowers of Pima cotton plants isolated in a plot of Acala cotton

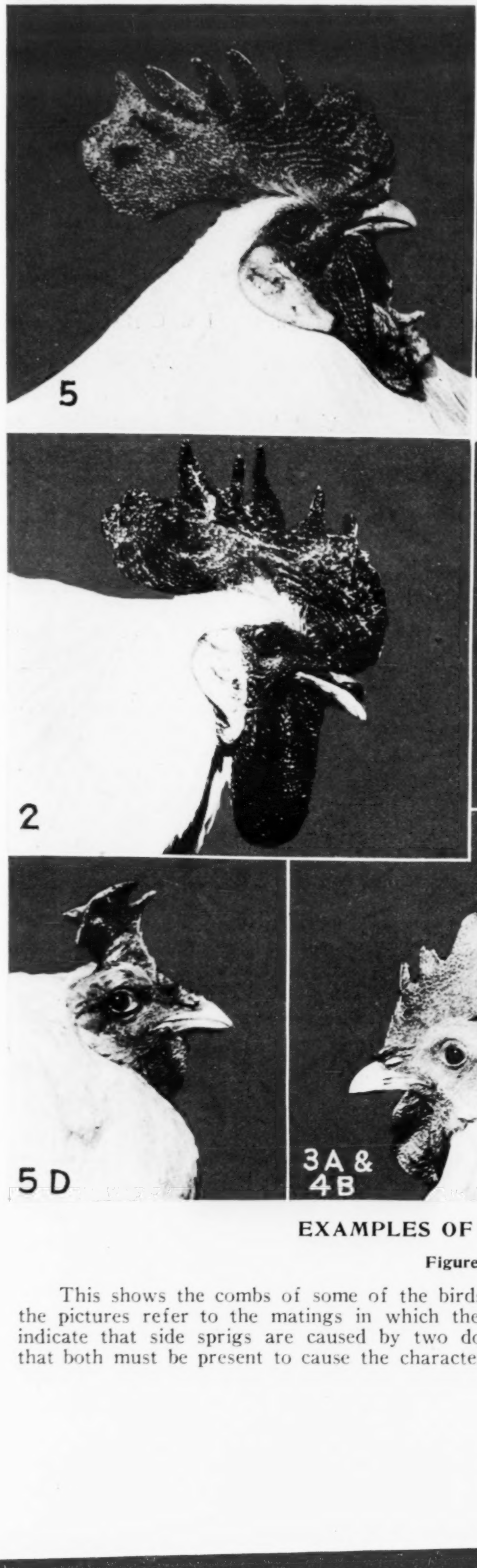
Treatment	*Number of seeds planted*	*Number of plants surviving* Total	Hybrids	*Perc't'ge of hybrids*
A Bagged as in ordinary selfing	445	309	0	0
B Bagged extra tight	450	265	0	0
C Not bagged (open-pollinated)	450	175	3	1.7

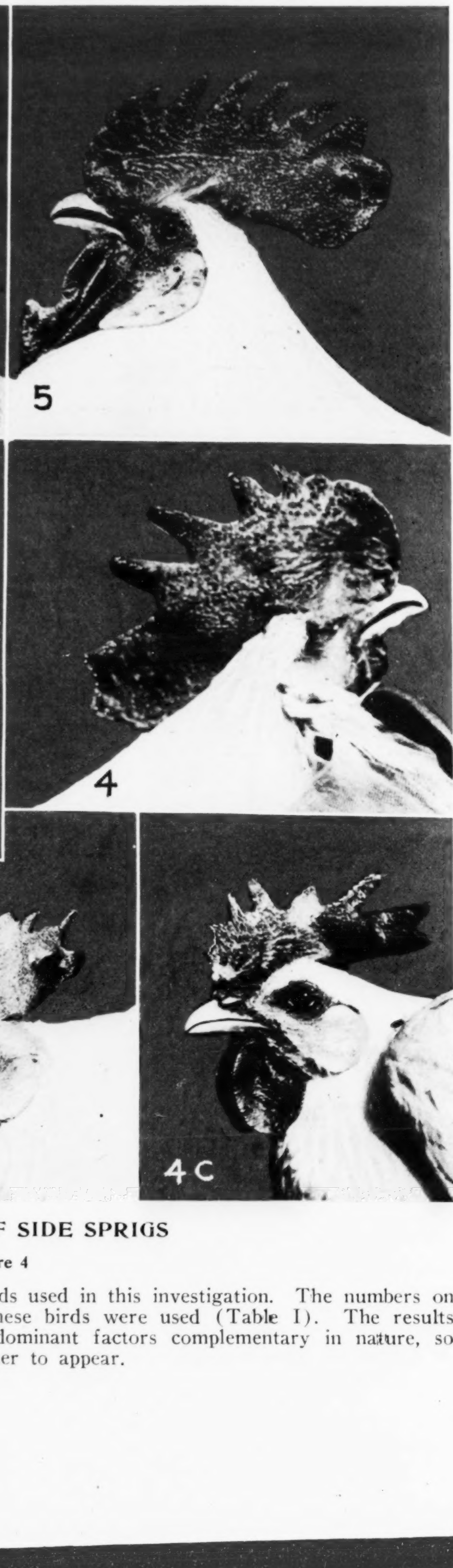
The Sterile Marriage

FERTILITY AND STERILITY IN HUMAN MARRIAGES, by EDWARD REYNOLDS AND DONALD MACOMBER, with a section of the Determining Causes of Male Sterility by EDWARD L. YOUNG, JR. Pp. 285, price $5.00 net. Philadelphia and London, W. B. Saunders Co., 1924.

This clearly written and well organized treatise is intended for physicians, but ought to be known to every eugenist. The authors conclude that about ten per cent of marriages are involuntarily sterile—an estimate that agrees interestingly with the figures obtained for rats bred under normai laboratory conditions. They discuss causes, methods of prevention and treatment, and present a convenient summary of Dr. Macomber's important breeding experiments with rats, on which is based the doctrine of relative sterility.

B. P.





EXAMPLES OF SIDE SPRIGS

Figure 4

This shows the combs of some of the birds used in this investigation. The numbers on the pictures refer to the matings in which these birds were used (Table I). The results indicate that side sprigs are caused by two dominant factors complementary in nature, so that both must be present to cause the character to appear.

INHERITANCE OF SIDE SPRIGS

Data on the Inheritance of Side Sprigs on the Combs of Single Comb White Leghorns

V. S. ASMUNDSON
University of British Columbia

LATERAL sprigs or side sprigs occur frequently on single combs of different breeds of fowls. Lamon and Slocum list them as a defect on the combs of Anconas, Andalusians, Javas, Orpingtons, Plymouth Rocks, and Rhode Island Reds. They apparently occur on the combs of practically all breeds that have single combs. According to Punnett[3], side sprigs also occur on rose combs and he states that single combed birds from Hamburghs showing the posterior trifid condition, often have small side sprigs. He further states "such evidence as I have collected points to the condition in which these sprigs are present being dominant to that in which they are absent."

Side sprigs on the comb disqualify a specimen for show. Canadian poultry breeders cannot enter females with side sprigs in the official Canadian contests nor can they be entered in the Record of Performance. Cockerels having side sprigs on their combs cannot secure Government approval. The trapnesting and pedigreeing of such birds or of birds that produce disqualified birds therefore represents wasted effort and an economic loss to the poultry breeder. Hence the study of the inheritance of this and other disqualifications is of practical importance besides offering a fertile field for genetic research.

Early Observations

Observations on progeny from matings that produced some individuals with side sprigs showed that the birds with side sprigs usually comprised 20 to 25 per cent of the total number of progeny. The parents were in all such cases free from side sprigs which seemed to indicate that they were inherited as a simple recessive. A report from a private breeder stated that a Barred Plymouth Rock male secured from the University of British Columbia when mated to females which like the male, were free from side sprigs, had given progeny of which approximately 80 per cent had side sprigs. This at once suggested the possibility that side sprigs are produced through the interaction of two factors both of which are required to produce side sprigs. This was adopted as a basis on which to plan matings.

On the basis of this theory, if S and S^1 are used to represent the two factors, birds with side sprigs would have the constitution SSS^1S^1, SSS^1s^1, $Ss^1S^1S^1$, or SsS^1s^1 while birds that do not show side sprigs would have the following genetic constitution with regard to this character: SSs^1s^1, ssS^1S^1, Sss^1s^1, ssS^1s^1, or sss^1s^1.

The experimental matings started in 1923 were planned to test this theory in so far as the stock and facilities available would permit. Single comb White Leghorns were selected because of availability and size of comb. Whilst all the expected ratios have not been realized the results of the matings made to date (see Table 1) seem to justify definite conclusions.

Classification

In most cases it is quite easy to determine whether a comb is, or is not, free from side sprigs, once the comb has reached the proper size. All birds having "a well defined pointed growth

*Contribution from the Department of Poultry Husbandry, University of British Columbia.

on the side of"[3] the comb, were classed as having side sprigs. The expression of this character is illustrated in Figure 4, which shows pictures of the heads of some of the birds used in the experimental matings. The number of side sprigs usually varied from one to three. This information together with information about the location of the side sprigs was noted.

It was usually possible to classify some of the cockerels when three to four weeks old while some of the pullets could not be classified definitely until several months old. This was a disadvantage since the mortality among the chicks from some matings which gave progeny with side sprigs was relatively high.

Discussion of Data

The matings made and for which data are summarized in Table 1, were matings of the following types with regard to the presence or absence of side sprigs:

(1) Males with side sprigs to females with side sprigs,

(2) Males with side sprigs to females without side sprigs,

(3) Males without side sprigs to females with side sprigs,

(4) Males and females without side sprigs but from parents with side sprigs.

(1) *Matings of males with side sprigs to females with side sprigs.*

From the first type of mating we would on the basis of the theory formulated above, expect progeny as follows:

(a) All with side sprigs,

(b) Three-fourths with side sprigs and one-fourth free from side sprigs, or

(c) Nine with side sprigs to seven without side sprigs.

Ten chicks were hatched from matings 2A, 2B, and 2C, made in 1924, and of these, eight that survived all had side sprigs. Since the hen used in mating 2C did not have side sprigs while the two other hens were heterozygous for side sprigs as shown by their breeding behaviour in other matings (see matings 1A and 6A) this result would seem to indicate that the male was homozygous for the factors for side sprigs. Unfortunately the male died before he could be tested further.

Matings 5A, 5B, and 5C gave progeny which when classified, more or less closely approximated to the ratio of 3 with side sprigs to 1 without side sprigs, or 19:6. The genetic constitution of the parents is probably that shown in Table 1.

The one male and two females used in matings 1A and 1B were from parents that did not have side sprigs, hence would be expected to be heterozygous for both factors and to give slightly more progeny with side sprigs than without side sprigs. The results obtained from these two matings, viz. 6 with to 5 without side sprigs, accord with the expected results. Mating 3A was apparently also of this type.

(2) *Matings of males with side sprigs to females without side sprigs.*

Two matings were made of a male with side sprigs to hens without side sprigs. Only two chicks were secured from one of these matings (mating 2C) and both had side sprigs, as mentioned before. Fourteen chicks were secured from mating 5E. On the basis of the type of mating shown in Table 1, equal numbers of birds with and without side sprigs would be expected, which agrees fairly well with the results actually obtained. A ratio of 1 with side sprigs to 3 without or of 3 with to 5 without would also be expected from some matings of this type but not enough matings were made to realize all the possible ratios.

(3) *Matings of males without side sprigs to females with side sprigs.*

Matings 6A and 6B in Table 1 show the results of mating a male without side sprigs to females with side sprigs. Theoretically the possible ratios would be the same as those indicated in the

preceding paragraph for the reciprocal cross. The ratio actually obtained is 1 with side sprigs to 5 without side sprigs, the expected ratio being 1 to 3. This agrees with the expected results in that it indicates that the male did not carry any factors for side sprigs. The deviation from the expected ratio is probably due to chance alone although the tendency seems to be to produce somewhat fewer than the twenty-five per cent of birds with side sprigs from matings which produce mostly progeny without side sprigs. Whether this is due to the comparatively heavy mortality of chicks and of embryos during incubation from some of these matings, cannot be satisfactorily determined from the data now available.

The results of these matings (matings 6A and 6B) are significant in that they indicate that neither of the factors for side sprigs is carried in the sex chromosomes. If one or both factors were carried in the sex chromosomes, only the males from these matings should have side sprigs whereas they actually produced 1 male and 3 females with side sprigs.

Matings 4B and 4C, so far as could be judged from the appearance of the birds were of the same type as matings 6A and 6B. The male was free from side sprigs (see Figure 4) but as shown by the progeny from mating 4A, he was either heterozygous or homozygous for one of the factors for side sprigs. The results of mating 4B do not agree with the results expected on the basis of matings 3A, 4A, and 4C. It is hoped to secure further data on this point by repeating the mating and raising more chicks. The results for mating 4C agree reasonably well with the expected results of 3:1.

(4) *Matings of males and females without side sprigs but from parents with side sprigs.*

In 1924 a male free from side sprigs was mated to his two sisters out of mating 1B, both likewise free from side sprigs. The 24 chicks reared were all free from side sprigs.

Mating 4A made in 1925 as shown in Table 1 gave different results since five out of the eight chicks from this mating had side sprigs. This agrees with the expected results of equal numbers or approximates a 1:1 ratio. Matings of males and females that do not have side sprigs but which between them carry both the factors for side sprigs may be expected to give progeny with and without side sprigs in the ratio of 1:3, 1:1, and 1:0 or all with side sprigs. None of the few matings of this type that have so far been made have given the last ratio of all the chicks with side sprigs.

The results reported in this paper indicate definitely that the presence of side sprigs on the combs of single combed White Leghorns is not determined by a single factor. If that were true either birds with side sprigs or birds without side sprigs would breed true whichever was recessive. This has been shown not to be true. The results reported can all be explained on the basis of two non sex-linked dominant factors that are complementary in their action so that when both are present, either in the heterozygous or homozygous condition, side sprigs are produced.

Summary

Matings of males with side sprigs to hens with side sprigs gave progeny

(a) all of which had side sprigs,

(b) three-fourths with side sprigs,

(c) equal numbers with and without side sprigs and in some cases slightly more with than without or approximating a 9:7 ratio.

Males and females without side sprigs produced chicks which had and did not have side sprigs in the ratio of 1:3 and 1:1.

Males without side sprigs mated to hens with side sprigs produced progeny nearly one-fourth of which had side sprigs. The chickens from all

the various types of matings that had side sprigs comprised both males and females.

These facts are interpreted to mean that the presence of side sprigs is determined by the interaction of two dominant factors neither of which is carried in the sex chromosomes.

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2. Lamon, H. M., and Slocum, R. R. 1920. The Mating and Breeding of Poultry, New York.

3. Punnett, R. C. 1923. Heredity in Poultry.

TABLE I—SHOWING THE RESULTS IN DETAIL OF MATING 6 MALES TO 13 FEMALES IN 16 DIFFERENT MATINGS MADE TO STUDY THE INHERITANCE OF SIDE SPRIGS. ALL THE PROGENY THAT SURVIVED TO AN AGE WHEN THEY COULD BE CLASSIFIED ARE INCLUDED

Year and Mating No.	Phenotype	Probable Genotype of Mating	Out of Mating	Progeny				
				With Side Sprigs		Without Side Sprigs		
				Males No.	Females No.	Males No.	Females No.	Total No.
1923-1A(a)	SS'	♂ SsS's'	Original	1	2	0	1	4
" -1B	SS'	♀ SsS's'	Original	3	0	1	3	7
1924-2A	SS'	♂ SSS'S'	1A	1	1	0	0	2
" -2B	SS'	♀ (b)	Original	1	3	0	0	4
" -2C	ss'	♀ SsS's'	1A	1	1	0	0	2
" -3A	SS'	♂ SsS's'	1B	3	2	4	1	10
1925-4A	ss'	♂ ssS's'	3A	2	3	2	1	8
" -4B	SS'	♀ SSs's'	3A	2	4	1	1	8
" -4C	SS'	♀ (c)	1A	4	1	1	0	6
" -5A	SS'	♂ SSS's'	2A	3	4	0	1	8
" -5B	SS'	♀ (d)	2B	0	3	1	0	4
" -5C	SS'	♀ (d)	2A	4	5	2	2	13
" -5D	SS'	♀ SsS's'	2C	2	2	0	0	4
" -5E	ss'	♀ SsS'S'(e)	2B	4	4	2	4	14
" -6A	ss'	♂ sss's'	Original	0	2	6	4	12
" -6B	SS'	♀ (f)	1A	1	1	5	5	12
		♀ SsS's'	Original					

(a). The numeral designates the male, the letter the female.

(b). Same as 1A.

(c). Same as 3A.

(d). The results obtained indicate that the hens used in matings 5A and 5B were heterozygous for the same factor as the male and heterozygous or homozygous for the other factor.

(s). This hen may be homozygous or heterozygous for both factors. Not enough chicks were raised to draw definite conclusions from these results.

(f). Same is 2B.

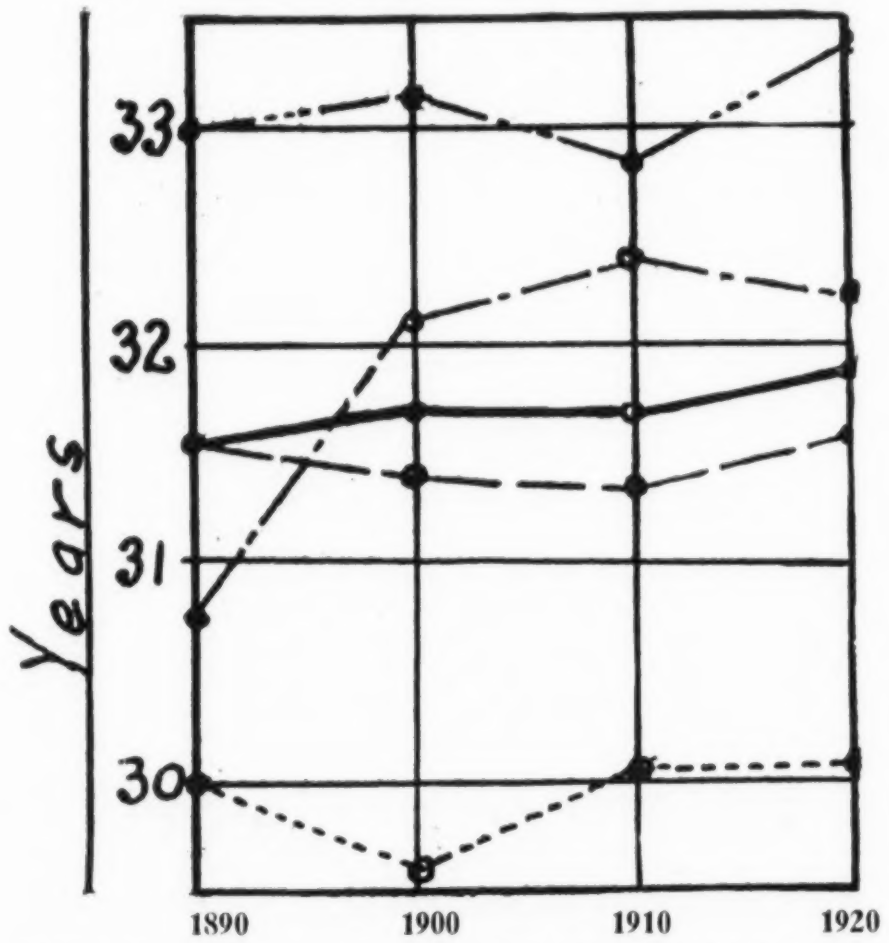
AGE-DISTRIBUTION AND FECUNDITY

Potential Effects of These Factors on the Birthrate, as Indicated by Census Figures, 1890-1920

ELBRIDGE SIBLEY

THE purpose of this paper is to investigate the basis of the frequently encountered assumption that one cause of a decline in the crude birthrate in this country is to be found in the increasing tendency of women to marry late or to remain single.

From the Censuses of 1890-1910*, no evidence for the validity of such an assumption can be found, either as regards the total population, or as regards any one of the principal nativity groups.†

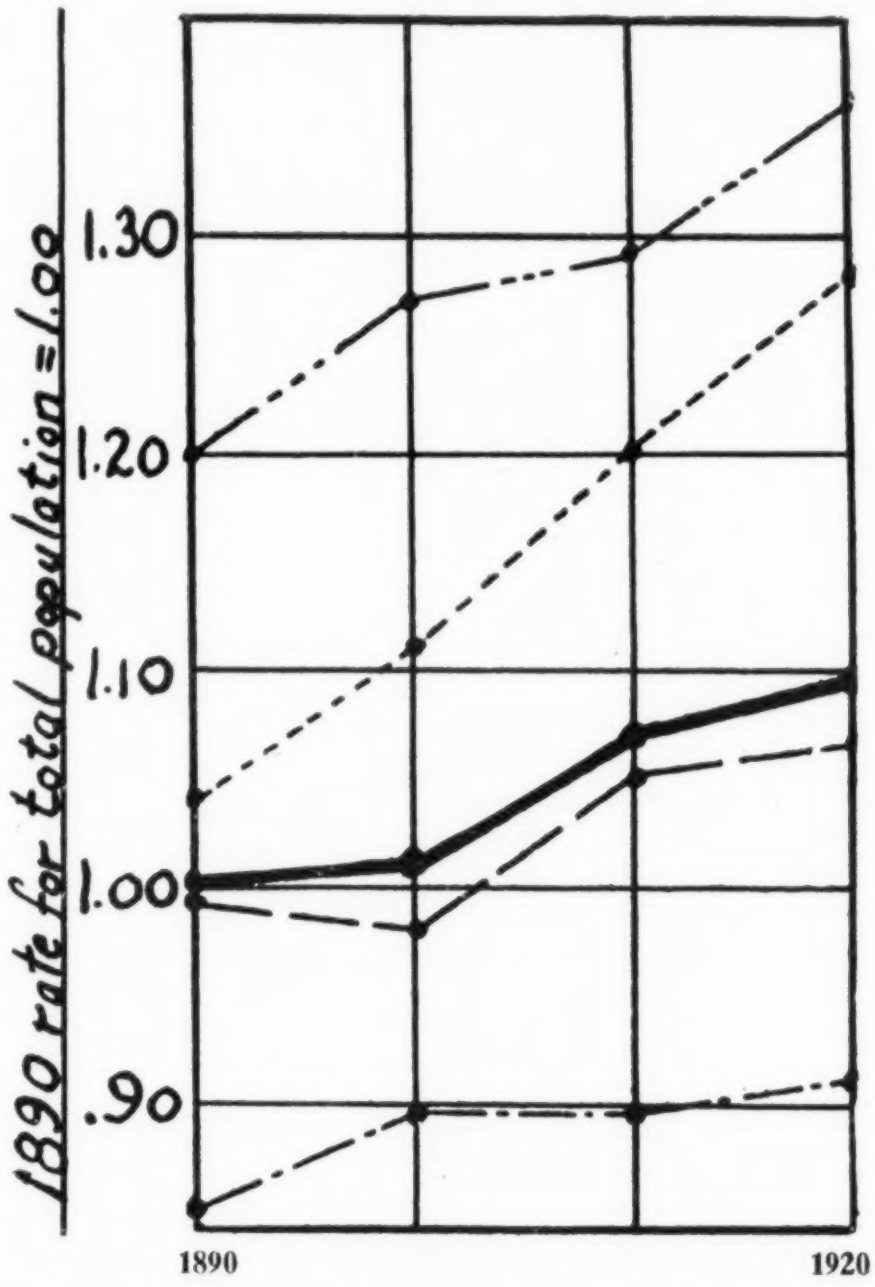


MEAN AGE OF MARRIED WOMEN‡

Figure 5

The chart shows the variations in the mean age of married women in the following classes of the population:

- Total population ————————
- Native whites:
  - of native parentage — — — —
  - of foreign or mixed parentage —·—·—·—·—
- Foreign-born
  - Whites —···—··—···—···
- Negroes - - - - - - - - - - - - -



RATIO OF MARRIED WOMEN‡ TO POPULATION

Figure 6

Symbols used are the same as in Figure 5. The ratio of married women to population has increased in all classes.

1. *Mean age of married women.*

The mean age of married women of ages from 15 to 45 years‡ increased during the three decades from 31.5 to 31.9, a matter of less than half a year. But at the same time, the mean age of all women in the same age-group

*Censuses before 1890 do not give distributions by age and conjugal condition of women.

†The nativity groups considered are (1) Native whites of native parents, (2) Native whites of foreign or mixed parentage, (3) Foreign-born whites, (4) Negroes.

‡"Married women" and "All women" when used in this paper refer only to those between the ages of 15 and 45.

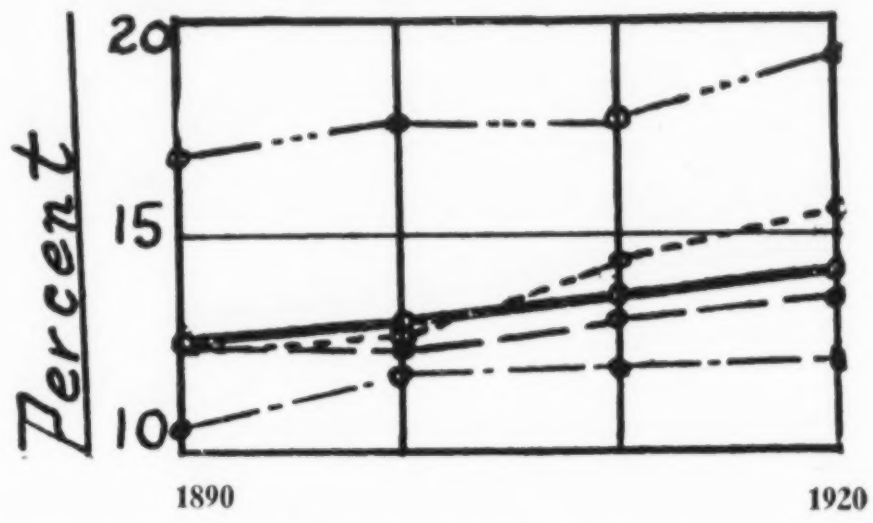
increased from 27.8 to 28.75, almost one year.

2. *Ratio of married women, and percentage of women married.* The mean age of married women is not the only factor influencing the crude birthrate to be expected. The number of married women per 100 population is equally important: in 1890 it was 12.7, in 1920, 14.2. This, *per se*, does not indicate necessarily a higher marriage rate; but it does when we also observe that there were, in 1890, 23.0 women between 15 and 45 out of a population of 100, while in 1920 there were 23.4. Thus in 1890, about 55 per cent of the women were married; in 1920, 61 per cent.

3. *Potential Crude Birthrates.* What of the net effect of the above changes in the composition of the population upon the crude birthrate which should be expected if individual fecundity remained constant? Since age-specific fertility rates for the United States as a whole are not available, we shall apply Tait's Law to obtain a rough approximation of the effect.* On this basis, the crude legitimate birthrate would be expected to have increased about 10 per cent between 1890 and 1920.

If all women, instead of only married women, be taken as a basis for computation, the expected rate shows a slight decline.

From an examination of the accompanying charts, it will be seen that



RELATIVE POTENTIAL BIRTHRATE

Figure 7

Symbols the same as in Figure 5. The actual decline in the birthrate has been due either to volitional restriction or to decline in biological fecundity, for the potential birthrate has been on the increase.

the trends for each of the nativity groups have been in the same directions as those for the total population.

This paper does not purport to answer the question whether the average woman at present is marrying later or earlier than the woman of 1890; it indicates that the net effect of whatever changes have taken place in birth, marriage, divorce, and death rates in the past three decades has been to produce a population having a higher potential birthrate than that of 1890; and that this is not due to the change in the age-composition of the whole population.

It follows that any decline in the actual crude birthrate (or indeed, the failure of the birthrate to have increased) must be due either directly to volitional restriction or to a decline in biological fecundity.

*Tait's Law, in general form, is:

$$Ft = k\,(b - t)$$

in which t = age, Ft = births per 100 married women aged t, and k and b are constants. Tait found b = 50 and k = 1.5. These values of the constants were used in computing the rates given in this paper. A very rough computation for rates in the birth registration area of the U. S. in 1922 gives k = 1.3, b = 45. The value assigned to k does not affect the comparisons between rates at different times, so long as k is held constant. Since the value of b varies for different population, but must be held constant for purposes of comparison, any value that may be assigned is somewhat arbitrary.

For an analogous application of Tait's law, see Elderton, E. M., Univ. of London Eugenics Laboratory Memoir No. 19, p. 5. (1914), and Stevenson, T. H. C., *in* The Declining Birthrate (rept. of National Birthrate Commission, London, 1916, p. 352. Also articles by Yule, Newsholme and Stevenson, *in* Jour. Royal Statistical Society, vol. 69 (1905).

THE COLLEGE MELTING POT

The Nature of So-called Mixed Marriages among the Parents of College Students

SAMUEL J. HOLMES
University of California

THE extent to which the fusion of different racial stocks is taking place in the United States is a question upon which we possess very inadequate information. The most extensive study of this subject has been made by Drachsler upon the foreign population of New York city.* This study dealt with 101,856 marriages among different foreign race stocks in the United States. But it excluded "all marriages where either the bride or the groom was born in the United States of native born parents (NBNP)." It is this latter kind of intermarriages with which the present brief paper deals.

The federal birth statistics yield indirect evidence of the intermarriage of different racial stocks by giving the number of births classified according to the nativity of the father and the mother. This affords only a very crude index of the extent of racial intermarriage, and since every person born in the United States of foreign-born parents is classified in the same category as the descendant of Mayflower ancestry, the data really throw little light upon the actual fusion of foreign stocks with persons of older American extraction.

Our data from the records of the few states which compile statistics on marriage suffer from the same defect. If we know that an Italian marries a woman born in the United States this fact is not necessarily indicative of racial assimilation; he may have married a member of the second or third generation of his own people. This is, of course, what would be expected, especially in communities, such as the Italian districts of our large cities, where recent Italian immigrants keep largely to themselves. Taken at their face value our marriage statistics would seem to indicate a considerable amount of fusion of foreign with American stock. Thus in Massachusetts during 1900, 12.1 percent of the marriages were between native-born men and foreign-born women, and 10.8 percent of the marriages were between native-born women and foreign-born men. Neither federal nor state statistics give us any clue to the racial extraction of the persons in the native-born category. How much assimilation these native-foreign intermarriages indicate is therefore left undecided.

The data upon which the present paper is based were assembled by one of my advanced students, Miss I. N. Smith. They are much less extensive than it is desirable that they should be, and the reason for publishing them is the fact that they bear upon a question about which we have so very little information. They are derived from the records which have been collected for a number of years at the University of California concerning the nationality of the parents and grandparents of college students. They consequently furnish information for a generation further back than the data supplied by our official statistics. In a previous paper on *The Size of College Families*†, which was based on these same data, it was pointed out that of the immediate parentage of our college students there were 3,042 fami-

*Intermarriage in New York City. N. Y. Columbia Univ., 1921.

†*Journal of Heredity*, 15, October, 1924.

lies in which both parents were native-born, 742 families in which both parents were foreign-born, and 647 families in which one parent was foreign-born and the other native-born. We are here concerned with the nature of the latter, or mixed group.

From the tables in which the results of our compilation have been embodied it may readily be seen that these marriages between native-born and foreign-born individuals are confined largely to the same general stocks. Thus, in Table I, it may be seen that where an Englishman marries a native-born woman the parents of his wife are English in 42 cases, American in 19, Scotch in 11, German in 11, Irish in 10, and French in 8 cases, with a smaller number of cases of other European nationalities. In every instance, apparently, either one or both of the wife's parents were of Nordic extraction. When the father is native-born but of English extraction (Table II) and chooses a foreign-born wife, she is in all cases except one (an Austrian) from a northern European country. The other British groups show much the same tendency.

German men tend to marry native-born women of German extraction (58 cases), or of other northern European derivation, and not improbably several of the 18 native American women of American parentage who married Germans were of German lineage one or more generations further back. In general, northern European men tend to chose American wives of northern European extraction, and native-born men of northern European parentage, when they marry foreign-born women, choose those of northern European extraction also.

There are relatively few students coming from marriages between southern European and native-born persons. But these mixed marriages tend, like the others, to occur within the same general groups. Thus, of the 8 marriages between Italian men and native-born women (Table I), five were with women of Italian parentage, two were with women of French parentage, and one with a woman whose parentage was given as American, although she may have been of Italian extraction. So far as these confessedly very limited data go, they indicate that marriages between the native-born and the foreign born tend to occur within the same or closely related national groups. Possibly the extent of intermarriage between different peoples is greater now than it was when the parents of our college population were married, and it may vary considerably in different parts of the country. Drachsler has shown that in New York city the marriages contracted by foreign-born persons were in a considerable percentage of cases (13.59 percent) between peoples of different nationalities, but his subdivisions of the peoples of several nations on the basis of ethic derivation considerably increases the percentage of cases classed as intermarriages. Our own data, so far as they go, indicate that for the period and classes of people considered, the melting pot was acting considerably more slowly than might be inferred from our available statistics on intermarriage.

TABLE I. MARRIAGES OF FOREIGN-BORN MEN AND NATIVE-BORN WOMEN

Extraction of Foreign-born Father	*Extraction of Native-born Mother*
English	English 42; U. S. 19; Scotch 11; German 11; Irish 10; French 8; Scotch-Irish 4; Dutch 3; Scotch-English 2; Danish 1; Swedish 1; Norwegian 1; German-French 1; French-English 1; Dutch-English 1; German-English 1; German-U. S. 1; French-Swedish 1; French-Italian 1; Irish-Italian 1.
German	German 58; U. S. 18; English 8; French 4; Scotch 2; Danish 2; Swedish 2; Scotch-Irish 2; Russian 1; Irish 1;

Extraction of Foreign born father	*Extraction of Native-born Mother*
German—Cont'd	Polish 1; Scotch-English 1; German-English 1; Scotch-Canadian 1; French-Irish 1.
French	English 3; French 2; U. S. 2; German 1; Austrian 1; Irish 1; Alsatian 1; German-English 1.
Russian	Russian 4; English 1; Austrian 1; Polish-Austrian 1.
Austrian	German 2; English 2; U. S. 1; Polish-English 1.
Scotch	English 16; Irish 6; German 5; Scotch 4; U. S. 4; French 3; Dutch 2; Welsh 1; Scotch-Canadian 1; Canadian-U. S. 1; Danish 1; Swedish 1; German-French 1; Scotch-Irish 1; Irish-English 1.
Irish	Irish 12; English 11; U. S. 7; German 5; Scotch 3; French 1; Welsh 1; German-French 1; German-Scotch 1; Canadian-U. S. 1.
Welsh	Welsh 2; English 2; U. S. 2; Irish 1.
Swiss	Swiss 3; German 3; English 3; U. S. 1; Irish 1.
Dutch	Scotch 2; German 1.
Serbian	Serbian 2; English 1; Irish 1.
Bohemian	Bohemian 2.
Portuguese	Portuguese 4; U. S. 1; Irish 1.
Canadian	English 3; Canadian 1; German 1; French 1.
Danish	U. S. 7; Danish 6; German 2; Scotch 1; Scotch-Irish 1; French-English 1.
Polish	German 2; U. S. 2; Swiss 1; Scotch-Irish 1.
Italian	Italian 5; French 2; U. S. 1.
Swedish	Swedish 4; English 3; German 2; U. S. 2; Scotch 1; Irish 1; Scotch-Irish 1; Scotch-English 1; Irish-English 1.
Norwegian	Norwegian 5; Scotch 3; U. S. 2; Irish 2; English 1.
Armenian	U. S. 1.
Irish-U. S.	English 1.
Belgian	English 1.
Russian-Dutch	English 1.
Scotch-Irish	English 3; Irish 2; U. S. 1; German-English 1.
Scotch-French	Irish 1; French-Scotch 1; Dutch-Swiss 1.
English-Scotch	English 2; German 2; U. S. 1; French-Scotch 1.
Scotch-U. S.	U. S. 1.
Bohemian-German	French 1.
German-English	German 2; German-Dutch 1.
French-German	English 1.
Irish-English	Irish 2; Irish-English 1; French-English 1.
French-U. S.	French 1.
French-Canadian	English 1.
French-English	U. S. 1; Armenian 1; Scotch-English 1; French-English 1.

TABLE II. MARRIAGES OF NATIVE-BORN MEN AND FOREIGN-BORN WOMEN

Extraction of Native-born Father	*Extraction of Foreign-born Mother*
English	English 24; German 4; Scotch-Irish 4; Swedish 3; French 2; Scotch 2; Austrian 1; Irish 1; Welsh 1; Norwegian 1; Irish-Welsh 1; Canadian-Irish 1.
German	German 11; English 6; Scotch 5; French 2; Austrian 1; Belgian 1; Swedish 1; Polish 1; Norwegian 1; English-Scotch 1.
United States	English 7; Canadian 7; German 6; Scotch 3; English-Scotch 2; U. S. 1; French 1; Welsh 1; Belgian 1; Finnish 1; Scotch-Irish 1.
French	English 2; Spanish 1.
Russian	Russian 3; German 1.
Austrian	Austrian 1; Polish 1.
Scotch	Scotch 6; English 5; Irish 2; German 2.
Irish	English 8; Irish 6; German 1; Dutch 1.
Welsh	Welsh 1; English 1; Irish 1; German-Polish 1.
Swiss	Swiss 1; English 1.
Dutch	Scotch 1; Irish 1; Swedish 1.
Danish	English 1.
Serbian	English 1.
English-Swiss	Swiss 1; German-French 1.
English-Scotch	Scotch 1; French 1.
English-Welsh	Welsh 1.
Canadian-English	English 1; English-Scotch 1.
U. S.-English	U S.-English 2; English 1.
French-English	English 1.
Irish-Scotch	German 2; English 1; Scotch 1; Irish-English 1.

Extraction of Foreign born father	*born Mother Extraction of Native-*
Welsh-Scotch	Irish-English 1.
German-Scotch	Scotch 1.
French-German	English-Scotch 2.
Dutch-German	German 1.
Welsh-Dutch	Scotch-Swedish 1.
Spanish-Irish	Irish 1.
Irish-U. S.	English 1.
Swedish-U. S.	Irish 1.

TABLE III. MARRIAGES OF NATIVE-BORN WOMEN WITH FOREIGN-BORN MEN

Extraction of Native-born Mother	*Extraction of Foreign-born Father*
English	English 42; Scotch 16; Irish 11; German 8; French 3; Swiss 3; Canadian 3; Swedish 3; Scotch-Irish 3; Austrian 2; Welsh 2; English-Scotch 2; Russian 1; Serbian 1; Norwegian 1; Belgian 1; French-German 1; Irish-U. S. 1; Russian-Dutch 1; French-Canadian 1.
German	German 58; English 11; Scotch 5; Irish 5; Swiss 3; Austrian 2; Danish 2; Polish 2; Swedish 2; English-Scotch 2; German-English 2; French 1; Dutch 1; Canadian 1.
United States	English 19; German 18; Irish 7; Danish 7; Scotch 4; U. S. 3; French 2; Welsh 2; Polish 2; Swedish 2; Norwegian 2; Austrian 1; Swiss 1; Portuguese 1; Italian 1; Armenian 1; Scotch-Irish 1; English-Scotch 1; French-English 1; Scotch-U. S. 1.
French	English 8; German 4; Scotch 3; French 2; Italian 2; Irish 1; Canadian 1; Bohemian-German 1; French-U. S. 1.
Russian	Russian 4; German 1.
Austrian	French 1; Russian 1.
Scotch	English 11; Scotch 4; Irish 3; Norwegian 3; German 2; Dutch 2; Danish 1; Swedish 1.
Irish	Irish 12; English 10; Scotch 6; Norwegian 2; Scotch-Irish 2; Irish-English 2; French 1; Welsh 1; Swiss 1; Serbian 1; Portuguese 1; Swedish 1; Scotch-French 1.
Welsh	Welsh 2; Scotch 1; Irish 1.
Swiss	Swiss 3; Polish 2.
Dutch	English 3; Scotch 2.
Serbian	Serbian 2.
Bohemian	Bohemian 2.
Portuguese	Portuguese 4.
Canadian	Canadian 1.
Danish	Danish 6; German 2; English 1; Scotch 1.
Polish	German 1.
Italian	Italian 5.
Swedish	Swedish 4; German 2; English 1; Scotch 1.
Norwegian	Norwegian 5; English 1.
Armenian	French-English 1.
Alsatian	French 1.
German-French	English 1; Scotch 1; Irish 1.
Scotch-Irish	English 4; German 2; Scotch 1; Danish 1; Polish 1; Swedish 1.
Scotch-English	English 2; German 1; Swedish 1; French-U. S. 1.
Irish-English	Scotch 1; Swedish 1; Irish-English 1.
Polish-English	Austrian 1.
French-English	English 1; Danish 1; French-English 1; Irish-English 1.
Dutch-English	English 1.
German-English	English 1; German 1; French 1; Dutch 1; Scotch-Irish 1.
German-Dutch	German-English 1.
German-U. S.	English 1.
German-Scotch	Irish 1.
Scotch-Canadian	German 1; Scotch 1.
Canadian-U. S.	Scotch 1; Irish 1.
Polish-Austrian	Russian 1.
French-Swedish	English 1.
French-Scotch	English-Scotch 1; French-Scotch 1.
French-Irish	German 1.
French-Italian	English 1.
Irish-Italian	English 1.
Dutch-Swiss	Scotch-French 1.

TABLE IV. MARRIAGES OF FOREIGN-BORN WOMEN AND NATIVE-BORN MEN

Extraction of Foreign-born Mother	*Extraction of Native-born Father*
English	English 24; Irish 8; U. S. 7; German 6; Scotch 5; French 2; Welsh 1; Swiss 1; Danish 1; Serbian 1; Canadian-English 1; U. S.-English 1; French-English 1; Irish-Scotch 1; Irish-U. S. 1.
German	German 11; U. S. 6; English 4; Scotch 2; Irish-Scotch 2; Irish 1;

Extraction of Foreign born father	*Extraction of Native-born Mother*	*Extraction of Foreign born father*	*Extraction of Native-born Mother*
German—Cont'd	Russian 1; Dutch-German 1.	Belgian	German 1; U. S. 1.
		Swedish	English 3; German 1; Dutch 1.
United States	U. S. 1.		
French	German 2; English 2; U. S. 1; Austrian 1; English-Scotch 1.	Polish	German 1; Austrian 1.
		Norwegian	German 1; English 1.
		Canadian	U. S. 7.
Russian	Russian 3.	Finnish	U. S. 1.
Scotch	Scotch 6; German 5; U. S. 3; English 2; Dutch 1; English-Scotch 1; Irish-Scotch 1; German-Scotch 1.	Spanish	French 1.
		German-Polish	Welsh 1.
		German-French	English-Swiss 1.
		Scotch-Swedish	Welsh-Dutch 1.
		Scotch-Irish	English 4; U. S. 1.
Irish	Irish 6; Scotch 2; English 1; Welsh 1; Dutch 1; Spanish-Irish 1; Swedish-U. S. 1.	English-Scotch	U. S. 2; German 1; Canadian - English 1; French-German 2.
		U. S.-English	U. S.-English 2.
Welsh	English 1; U. S. 1; Welsh 1; English-Welsh 1.	Irish-English	Irish-Scotch 1; Welsh-Scotch 1.
		Irish-Welsh	English 1.
Austrian	German 1; English 1.	Canadian-Irish	English 1.
Swiss	Swiss 1; English-Swiss 1.		
Dutch	Irish 1.		

TABLE V. SUMMARY OF RESULTS ON THE INTERMARRIAGE OF PEOPLES OF BRITISH EXTRACTION (NATIVES OF ENGLAND, IRELAND, WALES, SCOTLAND, CANADA, U. S.)

Men of British birth married to native-born women of British extraction	187
Men of British birth married to native-born women of non-British extraction	50
Men of non-British birth married to native-born women of British extraction	134
Men of non-British birth married to native-born women of non-British extraction	129
Foreign-born men of mixed British ancestry married to native-born women of British ancestry, 4; of non-British ancestry, 3; of mixed ancestry	5
Foreign-born men of pure British ancestry married to native-born women of mixed British ancestry	5
Foreign-born men of non-British ancestry married to native-born women of mixed British ancestry	6
American-born men of British extraction married to British women	98
American-born men of British extraction married to non-British, foreign-born women	28
American-born men of foreign, non-British extraction married to British women	21
American-born men of non-British extraction married to non-British foregn-born women	28
Native-born men of mixed British ancestry married to foreign-born women of British ancestry, 4; of non-British ancestry, 2; of mixed British ancestry	1
Native-born men of pure British ancestry married to foreign-born women of mixed British ancestry	1

The Reproductive Cycle in the Rabbit

REPRODUCTION IN THE RABBIT *by* JOHN HAMMOND, M. A., with a foreword and one chapter by F. H. A. MARSHALL, F. R. S., Edinburgh. Oliver & Boyd, 1925, 8vo. 200 pp. 15/-nett.

This admirable book, generously illustrated, should be read by every keeper of laboratory rabbits and by every student of the physiology of reproduction. Mr. Hammond is a patient and critical experimenter, and what makes this book valuable is that it is mostly an account of his own experiments. From these he marshals an impressive array of evidence in favor of the hypothesis first put forward by Mr. Walter Heape, that there is present in the blood stream in very minute quantity some substance ("a generative ferment") which controls both growth and reproduction. Normally there is only enough of this specific substance for either growth or reproduction. Thus, before puberty, growth absorbs all the supply; with the slowing down of growth, a surplus of the "ferment" becomes available which causes ovula-

tion to take place; after conception, pregnancy and lactation (both clearly phases of growth) in turn absorb the available supply of this substance and ovarian activity ceases.

Only in very exceptionally favorable conditions of warmth and food supply does a rabbit female successfully bear a second litter during lactation. Not infrequently she conceives again after the birth of a litter, but the second lot of embryos usually atrophies, since, we are told, the mammary glands are extracting from the blood stream all the supply of the specific substance. But on Mr. Heape's hypothesis, pure and simple, why should *all* of the generative ferment go to the mammary glands? On a straightforward mechanistic view, such as Mr. Heape's hypothesis purports to provide, one would surely suppose that some would go to the mammary glands and some to the uterus, that there would come into play something equivalent to the equipartition of energy; or are we to regard Mr. Heape's substance in terms of the quantum theory and suppose that there is usually present in the body at any given time only one indivisible quantum of the ferment? But if ovulation takes place after birth (as, in our experience, it almost invariably does in rabbits when copulation follows within a few days of parturition), then there must have been, at this stage at any rate, a partition of the substance between the mammary glands (to produce the milk) and the ovary (to produce ovulation), as, indeed, Mr. Hammond clearly states in the text.

The problem of the regulation of growth and reproduction (or indeed of any living process) is one of persistent fascination to the experimental physiologist. And as it becomes more and more evident that the process of regulation is usually complex, so we become more and more suspicious of any attractively simple explanation. Mr. Heape's notion of a generative ferment has proved itself useful in a rough and ready sort of way. But even if we grant the reality of this substance (and so far the evidence, though formidable, is only circumstantial), then we only transfer the problem back a stage, so to speak, and have to ask what is the mechanism which regulates the distribution of this substance between the different organs of the body? How does it come about that in the lactating rabbit, it is the second set of embryos which perish from an insufficiency of the generative ferment; while in the cow and the goat it is to the uterus that the ferment is drawn, and the milk supply drops off, owing (presumably) to the lack of generative ferment to stimulate the mammary glands? There is clearly some regulating process at work which holds the balance between growth and reproduction; but it is doubtful of Mr. Heape's simple hypothesis of the generative ferment throws much light on the inner working of this process.

M. S. Pease.

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A FURTHER STUDY OF THE HARVARD BIRTH-RATE

THE fact that Harvard alumni do not have enough children to maintain their number in the population has already been made known by Phillips in his earlier article[1] which was reviewed in the JOURNAL OF HEREDITY for December, 1916. The present article[2] continues the investigation of Phillips set forth in the earlier paper, by an examination of the Harvard graduating classes from 1891-1900, consisting of 5562 men.

Phillips' studies indicate that the graduates of Harvard probably make a poorer showing as regards birth-rate than do those of any other college men. Whereas some college groups are maintaining their number, the Harvard group is rapidly moving toward extinction. Recent studies of Dr. L. I. Dublin have shown that a stationary population will be maintained if each married couple has, on the average, 3.1 children. Dr. S. J. Holmes' investigation of the birth-rate of graduates of the University of California[3] showed this group to have a birth-rate of 3.25 children per married graduate, thus indicating that these men are probably maintaining themselves biologically, although by a narrow margin.

The percentage of celibacy and "sterility" however, is so high among the Harvard group that Phillips estimates that each Harvard family must have 3.52 children in order that the group reproduce itself. Against this estimated requirement the actual facts show that each married graduate has only 1.89 children, and the birth-rate for all graduates, married and single together, is only 1.45 children of which only 1.34 survive.

As compared with the earlier Harvard classes previously studied by Phillips, conditions do not show much change. There is a slight further decline in the birth-rate, but it is not very pronounced, indicating that this movement has nearly spent its force. This conclusion is best seen when the data are plotted graphically, that is the result showing a declining curve rapidly flattening out. The present birth-rate is so low, however, that little consolation can be derived from the fact that the decline has probably reached completion.

The Harvard men in the classes of 1891-1900 had on an average only .71 sons each. Considering this male line only, and applying this ratio to future generations, Phillips finds that the Harvard stock would become extinct in nineteen generations or in some 633 years. Using the method of calculation employed by Dr. C. B. Davenport, he estimates that a hypothetical Harvard class of one thousand men would be represented by but fifty male descendants two hundred years (six generations) hence. Application of his own method of calculation gave a somewhat higher estimate — one hundred twenty-eight male descendants at the end of two centuries. These illustrations show how rapidly the Harvard stock will disappear from the population unless there is a marked increase in the birth-rate.

One of the most alarming facts brought forth by Phillips' study, is the large increase in the percentage of absolutely "sterile" marriages. Of the men in the classes from 1851-1860 only thirteen per cent of those who married were childless, whereas of those in the decade 1891-1900 twenty-six per cent were childless, a figure higher than that of any other similar group of men. On the other hand, the percentage of men who married does not show much change during this period. Actually, the percentage of marriages

shows a slight increase, which is in accordance with the tendency throughout the entire population.

This increase in the percentage of "sterile" marriages appears to be due in a large part to two factors, firstly, the growing frequency of divorce and separations, although Phillips does not offer much data on this point; and, secondly, an increase in the age of the wife at marriage. Phillips estimates that the average age of the Harvard wife at marriage is now twenty-eight years. The close correlation between the age of the wife at marriage and the expectancy of children is well-known.

That the stock from which the Harvard men are drawn is rapidly dwindling in number is apparent from a comparison of the various racial or rather "nationalistic" groups of which the Harvard graduating classes have been composed. In the class of 1850, ninety-five percent of the men were of pure English-speaking descent. By 1900, this percentage had declined to 81 per cent, the remaining non-English speaking group of 19 per cent being made up as follows: 4.4 per cent French, 6.8 per cent German, 4.7 per cent Jewish, 2.4 per cent Scandinavian, and 3 per cent Russian. In the class of 1925 only 59 per cent of the men were of English speaking descent. Of course, in considering these figures it must be kept in mind that the period 1850-1925 was one of very heavy immigration from Continental Europe, and that the proportion of persons of British descent in the whole population was considerably lowered, but we would not expect the full force of this immigration to appear so quickly in the intellectual classes were the latter reproducing themselves as they should. From these figures it is strikingly apparent that the Harvard stock is rapidly disappearing from the population and is being replaced by another and an alien group.

Literature Cited

1. Phillips, J. C. *Harvard Graduates' Magazine,* No. 97, September, 1916.
2. Further Studies of the Harvard Birth-rate—Classes 1891-1900, by John C. Phillips. *Harvard Graduates' Magazine* for March, 1926.
3. Holmes, S. J. College men and the Birth-rate. *Journal of Heredity,* October, 1924.

Charles F. Stein, Jr.

Japan and Australia

West of the Pacific *by* Ellsworth Huntington. Pp. 453, price $4.50. Charles Scribner's Sons, 1925.

A most unusual and readable book of travels in Japan, Corea, China, Java and Australia by the author of *The Character of Races* and *Civilization and Climate.* The delightful style, fresh viewpoint and the sympathetic understanding and interpretation of the people of these countries by Professor Huntington make this book well worth thoughtful reading. His evaluation of the genetic qualities (especially temperament) of the various races and his consideration of the effect of physical and social environment in the selection of peoples make it of especial interest to readers of this journal.

In Yokohama he notes:

> But most of all the streets are bright because of the smiling faces of the men, the dainty charm of the women, and the delightful vivacity and merriment of the children. A race that so excels in these qualities has a tremendous asset. The Japanese children in their bright kimonos and sashes are one of the most charming things in the whole world.

His impression is that Japan is maintaining its rural strength and its substantial middle class better than is the United States. In discussing the health of the Japanese he considers three reasons responsible for the fact that Japan has the worst health, except for a few countries like Spain, Hungary, and Chile, among the comparatively advanced nations. These are (1) the unbalanced diet; (2), the great density

of population, and (3), the unfavorable summer climate. The heat and humidity of the summer sap the strength of the Japanese. The reviewer would suggest as additional reasons: the early marriage, the marital position, and lack of education of Japanese women. The greater number of the ablest men he finds coming from regions having the cooler summers.

In Japan it seems to me clear that an artistic temperament is very wide-spread and plays a fundamental part in the life of the whole people. When it comes to arranging flowers, setting a vase or a picture in the most advantageous position, making a garden, picking out and enjoying the beauty of nature, the Japanese seem incomparably superior to the Chinese. Yet when it comes to making a great work of art—a temple, a palace, an arch, or a bridge— the superiority of the Chinese is equally marked. If the Chinese could learn not only how to safeguard their health, but to reduce the number of their population by about one-half, the power of the Chinese as a nation would probably become several times as great as now.

His observations and discussions of conditions in Java and Australia are perhaps most noteworthy. He states that the density of the farming population in Java is 110 times as great as in the United States. The small size of the Javanese, their relatively short life and consequently larger proportion of children, their warm climate, the much greater yields of food per acre due to the several crops secured from the same soil each year, and the larger per cent of the land actually under cultivation account for a population 24 times as dense as ours. The rest is due to the difference in the standards of living. If Americans would adopt the simple life and standards of the Javanese the United States might have a population four or five times as dense as now. The Javanese lack initiative and power of independent and original action, which are found in the Dutch who control and have made possible the intensive development of the island.

The development of Queensland is considered from the viewpoint of having the largest all white settlement in the tropics. The average Queenslander decidedly excels the average American. They have no millions of negroes or lower classes of white immigrants such as have come to America not because of exceptional pluck and vigor but because they were miserable or because someone else, some vested interest, made it easy for them. Whether the white race can live permanently in such a tropical country appears to depend on (1) sanitation, medical practice and adaptation of life to tropical conditions and (2) natural selection. Alcoholism, conservatism in habits of life, especially in lack of comfortable homes, and the almost universal desire for immigration to increase the population without considering the quality of the immigrant seem the great dangers to Australia.

George M. Darrow.

A Revised Encyclopedia

HANDWOERTERBUCH DER SEXUALWISSENSCHAFT, edited by MAX MARCUSE. 2d, greatly enlarged edition with numerous illustrations, pp. 800. A. Marcus & E. Webers Varlang. Bonn, 1925.

This unique and valuable reference work is now appearing in a revision which extends its scope and brings it up to date.

P. P.

POLLEN COLLECTED ON GLASS PLATE

Figure 8

In order to obtain more quickly second generation plants of sorghum hybrids, the original crosses have frequently been made in the greenhouse at Washington, D. C. Sorghum plants grown during the winter are undersized and very often the quantity of pollen produced is small. The use of a glass plate in collecting pollen is helpful because the operator can easily see how much he obtains from any head.

A METHOD OF CROSSING SORGHUMS

H. N. VINALL

Bureau of Plant Industry, United States Department of Agriculture.

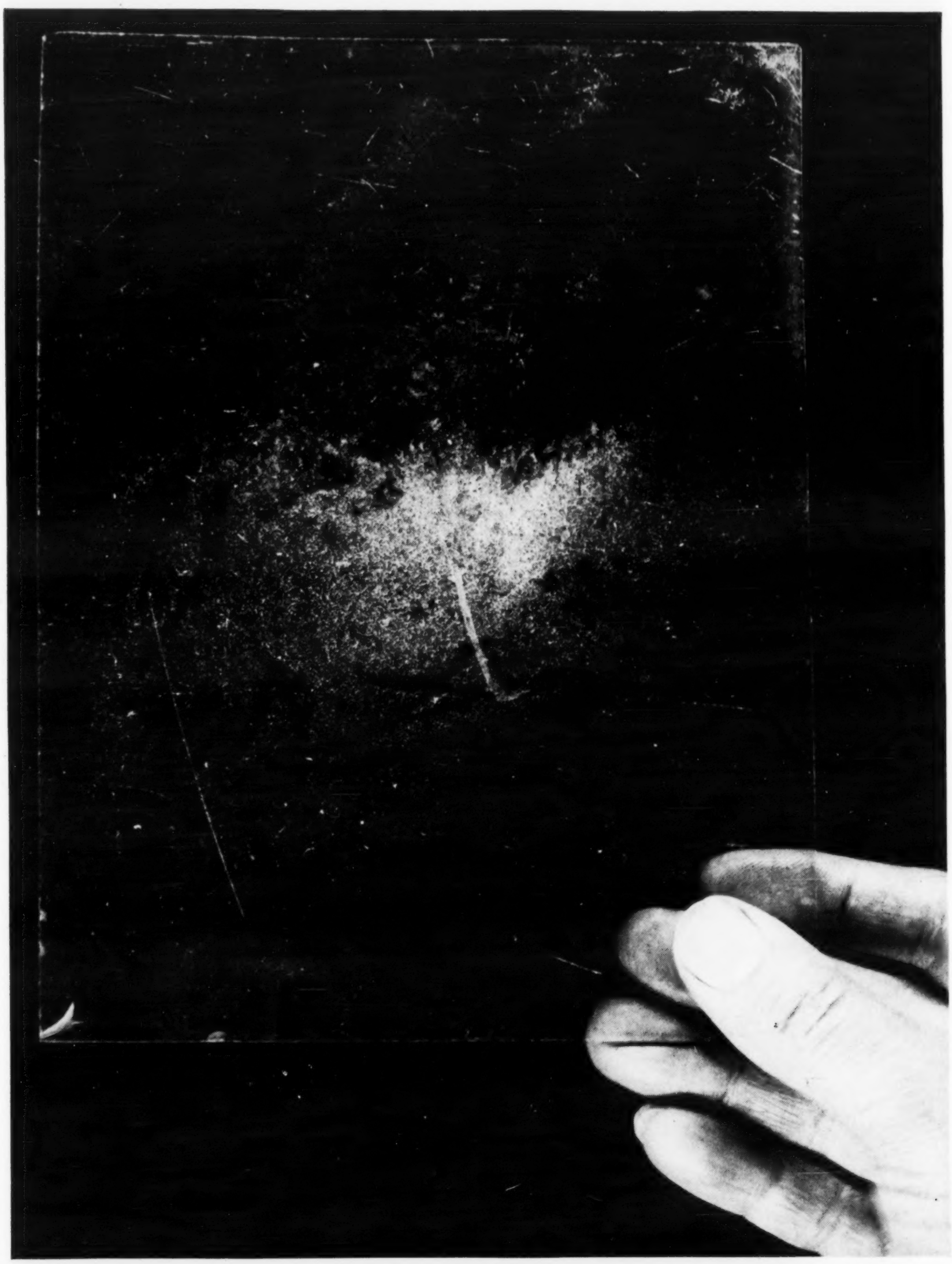
IN THE production of sorghum hybrids under greenhouse conditions at Washington, D. C., a simple method for collecting the pollen has been devised which may be of use to other workers. It no doubt can be used in the field if there is not too much wind, and the atmosphere is not too dry.

The only equipment necessary in addition to the customary cross-pollinating shears and forceps is a glass plate about six inches by eight; ordinary window glass will do. After the plant which is to be used as the female parent is chosen and the flowers that have been emasculated are ready for pollination, the pollen from the male parent is collected on the glass plate as shown in Figure 8. Holding the plate with one hand in a horizontal position, the head or panicle of the male parent is bent over with the other hand and struck sharply against the plate repeatedly until a quantity of pollen is jarred off on the plate as shown in Figure 9. This pollen, at least in a humid climate like that at Washington, D. C., will cling to the glass even though it be carried in a vertical position.

Holding the head to be pollinated in the left hand as indicated in Figure 10, the pollen is rubbed off the glass on the protruding stigmas. This method of getting the pollen on the stigmas has been found satisfactory. It is a rapid although not a particularly refined way of accomplishing the transfer of the pollen. If the operator desires to be more exact and pollinate each flower separately he may easily take the pollen from the glass surface on a knife blade or scalpel or with a camel's hair brush and place it on each individual flower. This will perhaps result in a larger percentage of successful crosses, but the production of a given number of seeds will require more time than the emasculation of larger members of the flowers and their pollination by the grosser method.

The advantage of using a glass plate on which to gather the pollen is easily apparent. The pollen can easily be seen and the operator knows when he has an amount sufficient to fill the needs of the case. After the transfer of the pollen is accomplished in a given case the glass may be easily and thoroughly washed and is ready for a new operation without danger of mixing the pollen.

The writer found in his greenhouse work that it was possible to collect viable pollen at 8.30 or 9 a. m., even though the sorghum flowers opened in greatest numbers much earlier in the morning. A dark cloudy day was to be preferred, however, to a bright, sunny one. The spikelets on the panicle of the female parent are all removed except the 12 or 15 which are to be emasculated and after the stamens have been removed from these they are bagged with a small glassine bag as seen in Figure 10. This emasculation is most easily done about one day before the flowers are ready to open. Care must be used, however, in working with flowers so nearly mature to see that none of the stamens burst when they are being removed and leave some of their pollen grains on the stigmas. In most cases the stigmas are not receptive at this stage, but it is just as well to avoid even such remote chances of selfing. It usually



POLLEN CLINGING TO THE GLASS PLATE

Figure 9

If care is used in choosing a head that is shedding pollen freely, a liberal quantity may be obtained by this method in a few seconds.

TRANSFERING POLLEN TO EMASCULATED FLOWER-HEAD

Figure 10

In the humid atmosphere of a greenhouse the pollen clings to a glass surface so well that it is possible to turn the plate upside down and rub the pollen off on the exposed stigmas without losing much of it. If there is plenty of pollen on the glass it may be held directly over the emasculated flowers and the pollen jarred off on the stigmas by tapping the plate with one's finger. (*Right*) There is little danger of natural cross-pollination in the greenhouse, but it is well to eliminate all possibility of this by bagging the emasculated flowers of the proposed female parent. Glassine bags, size 2½x5¾ inches are well suited for this purpose and may be fastened to the stem with an ordinary wire paper clip.

requires two or three days after emasculation for the stigmas to develop and become fully exserted from the dehiscent glumes. After applying the pollen the bag is replaced to protect the stigmas from other foreign pollen.

PIEBALD SEEDLINGS

Figure 11

Seedlings of piebald 1, line-b. When the seedlings are very young green tissue is limited to the tips of the leaves, with color just beginning to show at the base of the leaves. Two older seedlings are also shown (lower right), in which the third leaves have a much larger area of green than the earlier ones. The irregular spots are characteristic of the piebald lines. In this line the later leaves are entirely green.

HERITABLE CHARACTERS OF MAIZE

XXV—Piebald Seedlings*

M. DEMEREC

Department of Genetics, Carnegie Institution of Washington, Cold Spring Harbor, New York

A SHORT description of piebald seedlings in maize and the evidence as to the number of genetically different factors which produce the piebald phenotype, were given in a paper read at the Washington meeting of the American Association for the Advancement of Science.† In the present paper a detailed account of the piebald group will be presented.

In the piebald group are placed all chlorophyll types having irregular white or yellowish spots. These spots are extremely variable in size, shape and location. They may cover the whole leaf or may appear as small dots. The transition from the white to the green tissue is ordinarily sharp; sometimes, however, the transition region looks pale green, because layers of the green and the white tissue overlap. The piebald spotting is unlike the variegation of japonica type in that it is irregular and does not follow the cell lineage as japonica does.

Origin and Description of the Piebald Seedlings

Piebald seedlings were found in several varieties of maize and six of them were used in these investigations. The seedlings in four of the varieties were of a very light type, i. e., they had large and distinct white spots, which in many instances extended through the greater part of the leaves giving the seedlings an albino appearance. The piebalds in the other two varieties were of the dark type, i. e., they had small, and in many cases, indistinct, white spots.

The description and origin of these six different lines of piebald seedlings is as follows:

Line-a is a line of piebald seedlings of a very light type. The green tissue of these seedlings is limited to the extreme tip of the leaves, and it is sharply separated from white tissue of the rest of the seedlings. The base of the leaves and the stems of the seedlings were always found to be white but in several cases green streaks were noticed on the coleoptile. The green areas on the leaves are so small that all seedlings die in the early seedling stage. A special effort was made to grow these piebald plants to maturity, but without success. Among many seedlings examined several were observed in which the green tissue was limited to an area of less than one square millimeter in size, but not one entirely white seedling was found.

This piebald line originated from a piebald plant found by Professor R. A. Emerson among Golden Bantam maize grown in his garden.

Line-b is also a light type, piebald seedlings having the green tissue limited to the extreme tips of the leaves. Young seedlings of line-b differ from those of line-a by having green coleoptiles. In the later stage of growth, however, the difference between the seedlings of these two lines is very pronounced. As already mentioned, the seedlings of line-a remain white

*Experiments reported in this paper were completed at the Department of Plant Breeding of Cornell University, Ithaca, New York.

†DEMEREC, M. Genetics of four groups of seedling characters which affect the development of of chlorophyll in maize. (Abstract.) *Anat. Rec.* 29:133. 1924.

PIEBALD SEEDLINGS OF LINE-E

Figure 12

These Piebald plants are very similar in appearance to those shown in Figure 11, but they are determined by genetically different factors, as in crosses of Piebald$_1$ and Piebald$_2$, (lines e and f) the first generation is normal in color.

and invariably die, while the seedlings of line-b begin to turn green at the two leaf stage, develop the later leaves entirely green (see Figure 11), and at maturity have a normal green appearance. The greening on the first leaves is very irregular. Usually the chlorophyll starts to develop from the base of the leaf (see Figure 11), and sometimes the whole leaf becomes green, but frequently irregular spots of different sizes are left white (Figure 11). By closer examination of mature plants these white spots can be observed on some of the first leaves, but since first leaves usually die, the mature plants are ordinarily entirely green.

Origin of the piebalds of line-b was a self-pollinated ear number 769-5 taken from Doctor E. G. Anderson's cultures.

Line-c. Piebalds of this line are of a light type, but not as light as those of line-a. They have smaller or various sized white spots extending usually through the middle of the leaf. The third, and in many instances even the second leaf, is usually entirely green. Mature plants are as far as observed, always green.

Seed of this line was obtained from a self-pollinated plant of the Early Pride variety, received from the Agricultural Experiment Station at Cordon, Montana.

Line-d comprises piebald seedlings of a very dark type. Small and irregular white spots can usually be seen on the first leaves of young seedlings, but sometimes the spots do not show at all and the piebald seedlings can

LEAVES FROM A MATURE PIEBALD PLANT

Figure 13

These leaves are from a plant of line-e (Piebald$_4$). In this strain the piebald leaves are found on plants of all ages, and the later leaves are not entirely green, as is true of some of the other piebald strains.

not be distinguished from the green ones. Mature plants are green.

This line originated from the variety Mandan soft white, obtained from the Agricultural Experiment Station at Cordon, Montana.

Line-e is of a light type. Piebald seedlings of this line usually have a large and irregular white spot through the middle of the leaf. The tip and the base of the leaves are ordinarily green (Figure 12). Mature plants are regularly spotted (Figure 13).

This piebald was found in the progeny of seeds marked "Burleigh Co. mixed," a sample of which was obtained from Mr. O. H. Will of Bismarck, N. D.

Line-f involves piebalds of a dark type. The seedlings have irregular white spots through the middle of the leaf, which are usually smaller than those of line-e; and sometimes these seedlings are even completely green. Mature plants are usually green, but on some of them white spots could be noticed.

This piebald originated from variety Will's *Gehn* yellow flint obtained from Mr. O. H. Will.

Inheritance of Piebald Seedlings

The results of genetic tests showed that two of the three piebalds are simple Mendelian recessives to green, and that the third one is determined by duplicate genes. In the F_2 generation of a cross between the latter piebald (pb_2 pb_2 pb_3 pb_3) and a green plant, segregation in 15:1 ratio was observed with a total of 304 greens to 21 piebalds, the deviation from expectancy being $.69 \pm 2.94$. In several backcrosses of F_1 plants with homozygous piebalds a segregation in a 3:1 ratio was obtained with a total of 1269 greens to 414 piebalds and a deviation from expectancy of 6.75 ± 11.9. These results show conclusively that the piebald involved in these crosses was determined by duplicate genes.

Intercrosses Between Different Lines

All possible intercrosses between different lines of piebalds were made, and in the F_1 generation piebalds were obtained only in the crosses between lines $a \times b$, $c \times d$, $e \times f$, showing that these piebalds were determined by allelomorphic factors. Piebalds from lines *a* and *b* were therefore called piebald 1, from lines *c* and *d* piebald 2-3 (because they are determined by duplicate genes), and piebalds from lines *e* and *f* piebald 4.

It is interesting to note that piebalds phenotypically very different, were found to be genetically alike, and those phenotypically similar were found to be genetically different. Piebalds from line-b, for example, are much more similar to those from line-e than the piebalds from line-f, but the experiments show that the latter two were genetically alike.

Experiments were not carried far enough to tell whether the differences between the different lines of the same piebalds were due to certain modifying factors or to different allelomorphs of piebald. It has been noticed, however, that different lines were constant when inbred as well as in the crosses, which suggests that the differences were due to different allelomorphs. On the other hand the fact that in the case of two piebalds (piebald 2-3, and piebald 4) different lines came from the same places if not from the same variety, suggests the possibility that phenotypical differences between the lines are due to modifying factors.

A summary of the results from intercrosses made with the three piebalds is given in Table I, from which it can be concluded that all of the piebalds used in these crosses were genetically different.

All possible intercrosses were made here and the F_1 and F_2 generations were grown. The F_1 in each case was green and the F_2 segregated in such ratios as to show that the characters involved were determined by different factors.

In the F_2 generation of the cross between *pb₂ pb₂ pb₃ pb₃*, which is a piebald determined by duplicate genes, and *pb₄ pb₄*, from line-e, a segregation in green and piebalds in 45:19 ratio was observed. This ratio is a modification of a trihybrid ratio expected in a cross in which two phenotypically indistinguishable characters are involved, one of them being a simple Mendelian recessive and the other being determined by duplicate genes. On the other hand, in the F_2 generation of the cross between *pb₂ pb₂ pb₃ pb₃* and *pb₄ pb₄* from line-f, a dihybrid segregation in 9:7 ratio was obtained. This indicates, that one of the duplicate genes of *pb₂ pb₂ pb₃ pb₃*, was present in homo-

TABLE I—SUMMARY OR DATA FROM INTERCROSSES BETWEEN DIFFERENT PIEBALD PLANTS

				pb_1	pb_4
pb_2 and pb_3 (Duplicate genes)	F_1			green	green
	F_2	9 : 7 (3:1 & 3:1) ratio	Observed	69 greens 50 piebalds	697 greens 548 piebalds
			Calculated	66.95 52.05	700.3 544.7
			Difference	2.05 ± 3.65	3.3 ± 11.85
		45 : 19 (3:1 & 15:1) ratio	Observed	54 greens 26 piebalds	921 greens 371 piebalds
			Calculated	57.66 24.34	908.44 383.56
			Difference	3.66 ± 2.79	12.56 ± 11.08
pb_4	F_1			green	
	F_2	9 : 7 ratio	Observed	266 greens 185 piebalds	
			Calculated	254.8 198.2	
			Difference	13.2 ± 7.12	

TABLE II—SUMMARY OF THE DATA FROM LINKAGE TESTS INVOLVING Pb, pb, and Pb, pb,

Factors involved	F_1		Pb X*	pb X	Pb x	pb x	Total	X^2	P
R r	R Pb_1 selfed r pb_1	Observed Calc. 9:3:3:1	710. 726.2	235. 242.1	276. 242.1	70 80.6	1291	6.7120	.083
Su su	Su Pb_1 selfed su pb_1	Observed Calc. 3:1,3:1 Difference	2546. 2577.75 29.75±17.0	889. 859.25	703. 690. 13.0±8.86	217 230	4357		
Lg lg	Lg pb_1 selfed lg Pb_1	Observed Calc.9:3:3:1	313 295.9	88 98.6	91 98.6	34. 32.9	526	2.7503	.401
Y y	Y pb_1 selfed y Pb_1	Observed Calc.9:3:3:1	1018 1056.4	370 352.1	359 352.1	131. 117.4	1878	3.9144	.273
D d	$\frac{D_1}{d_1}$ $\frac{pb_1}{pb_1}$ selfed	Observed Calc. 9:3:3:1	1257 1319.8	448 439.8	448 439.8	163. 146.6	2346	2.9557	.353
Y y	$\frac{Y\ pb_2 pb_3}{y\ pb_2 pb_3}$ back cross	Observed Calc.3:1:3:1	537 540.75	176 180.25	560 540.75	169. 180.25	1442	1.3234	.727

*Xx stands for any of the factors listed in the first column.

zygous recessive condition in line-f of *pb*₄ *pb*₄, but was not present in the material of line-e. Similar results were obtained in the crosses between *pb*₂ *pb*₂ *pb*₃ *pb*₃ and *pb*₁ *pb*₁.

Linkage Tests

A summary of the data from linkage tests with different piebalds is given in Table II and III, from which it can be seen that piebald-1 is not linked with *R r, Su su, Lg lg, Y y,* and *D d,* factors, piebald 2-3 are not linked with *Y y,* and piebald 4 is not linked with *Wx wx, Su su, Lg lg, Y y* and *Gl gl* factors.

Summary

Piebald seedlings have on their leaves irregular white spots usually of large size. These spots may remain until maturity or may disappear with age.

Four genetically different factors for piebalds were found; two of them *Pb*₁ *pb*₁ and *Pb*₄ *pb*₄) are simple Mendelian recessives, and the other two (*Pb*₂ *pb*₂ and *Pb*₃ *pb*₃) are duplicate genes.

TABLE III—SUMMARY OF LINKAGE DATA FROM BACKCROSSES INVOLVING Pb_4 pb_4

F_1	Parental Combinations.		Recombinations		Total	Calculated	Difference
	Pb	pb	Pb	pb			
$\frac{Wx}{wx}\ \frac{pb_4}{Pb_4}$	265	263	264	251	1043	521.5	6.5 ± 10.9
	Total 528		515				
$\frac{Su}{su}\ \frac{pb4}{Pb_4}$	233	280	279	248	1040	520	7.0±10.9
	Total 513		527				
$\frac{Lg}{lg}\ \frac{pb_4}{Pb_4}$	293	283	294	278	1148	574	2.0±11.4
	Total 576		572				
$\frac{Y}{y}\ \frac{Pb_4}{pb_4}$	409	402	399	392	1602	801	10.0±13.5
	Total 811		791				
$\frac{Gl^*}{gl}\ \frac{Pb_4}{pb_4}$	234	209	229	217	889	444.5	11.5±10.06
	Total 443		446				

*Origin of this glossy (Gl gl) was Aq (498-8).

NEWS AND NOTES

Standardized Pedigree Charts

THE Committee on Standardization of Pedigree Charts, appointed by the International Commission of Eugenics in London, 1925, has considered what it deemed the best and most widely used systems of constructing pedigree charts. The essential features of the system which was originated by a committee of the American Breeders' Association in 1910, and which has since become the basis for standard usage by investigators in several different countries, were judged the best adapted to the purpose. Because of the wide use of this system in research, and because of the satisfaction with which it serves its purpose, there seems to be no reason to adopt or to recommend another system. The Committee on Standardization of Pedigree Charts therefore recommends the general use, by students of eugenics in all countries, of the following system (which is essentially the one referred to above) for the preparation of human pedigree charts:

1. The Sample Pedigree Chart is an example which shows the manner of construction and the use of symbols. (See accompanying diagram of the sample Pedigree Chart p. 308.)

2. The chief characteristics of this system of charting are:

(a) Males are represented by squares; females by circles; sex unknown by squares tilted at forty-five degrees; still-birth or miscarriage by a heavy black dot.

(b) Horizontal lines joining the center of symbols, right and left, indicate marriage; vertical lines descending from a marriage line indicate offspring. Several children in the same family are indicated by their respective "Descent Lines" from a horizontal "Fraternity Line," which later is, in turn, joined above by a vertical "Descent Line" with the "Marriage Line" of the parents.

(c) The rectangular system of indicating connections is preserved as consistently as possible. (Thus, on the "Sample Pedigree Chart," individual II-8 married, out of his generation, with III-17. Their child is designated IV-1.)

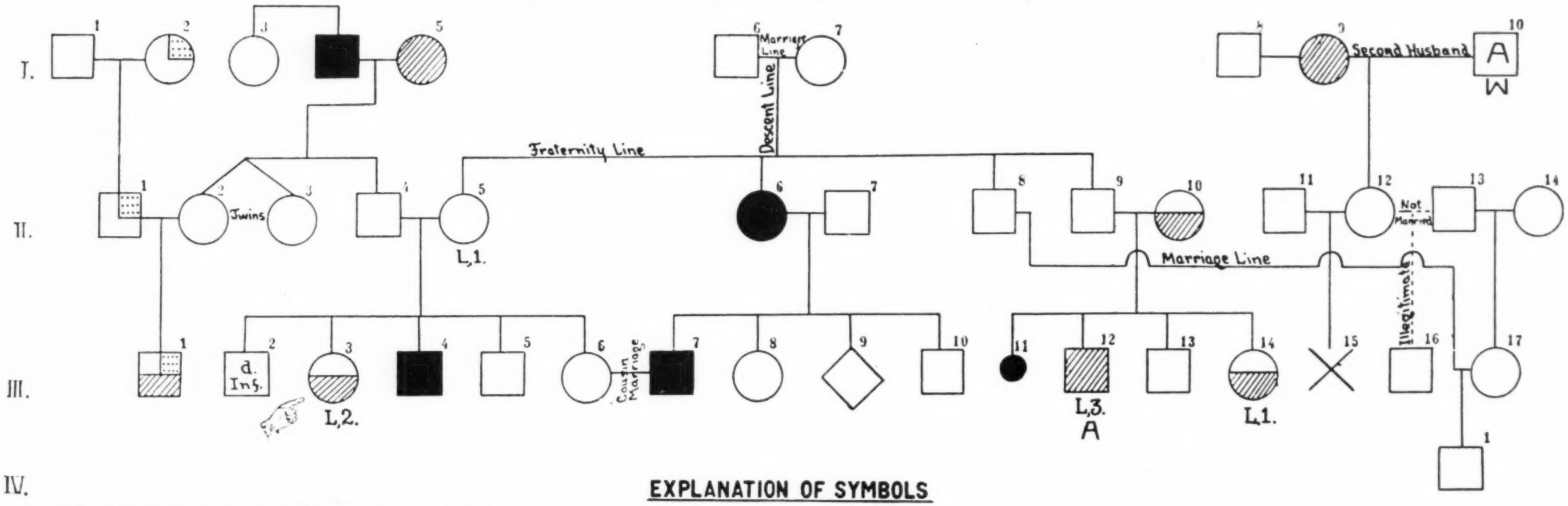
(d) The generations are designated by Roman numerals placed at the left of the horizontal row in which the symbols for the members of the particular generation are charted.

(e) The individuals in the particular generation, both blood kin and kin by marriage, are designated serially, from left to right, by Arabic numerals.

(f) For each pedigree chart about to be constructed, the investigator should devise, for the particular traits or characteristics to be listed, a system of appropriate signs or of letters. In the case of each person described, the signs or letters corresponding to his or her traits or characteristics should be placed near the symbol which represents the particular individual.

(g) A legend or explanation of the standard symbols, and of the special signs or letters which are selected for describing persons and traits on the particular chart, should accompany each pedigree chart constructed.

SAMPLE PEDIGREE CHART SHOWING THE MANNER OF CONSTRUCTION, AND THE USE OF STANDARD AND SPECIAL SYMBOLS.



IV.

EXPLANATION OF SYMBOLS

(a). Standard for all Pedigree Charts:

□=Male; ○=Female; ◇=Sex unknown; ●=Still-birth or Miscarriage; X=Children — number and sex unknown; ○○=Twins; d.Inf.=Died in Infancy; Points to the Propositus or central figure in the pedigree.

□—○=Parents.

□○□○○=Children.

Roman figures to the left indicate generations; Arabic figures locate individuals, (thus III.7 is the young man in the third generation who married his cousin).

The following letters, placed in or around the individual's pedigree symbol, are standard for certain traits: A, alcoholic; B, blind; D, deaf; E, epileptic; F, feebleminded; I, insane; M, migraineous; N, normal in reference to traits under consideration; Ne, neurotic; P, paralytic; Sx, sexually immoral; S, syphiletic; T, tuberculous; W, wanderer.

(b). Especially devised or selected for this particular pedigree-chart:

■● = Successful leaders in politics. ◱◔ = Extra thumb on right hand. L.1. = Highly successful author. L.3. = Little or no ability in literary efforts. ▨◍ = Superior in vocal music. ▨◍ = Medium attainment in vocal music.

To fit the particular family and traits (whether physical, mental or temperamental; good or bad) under consideration, invent special symbols, or select special letters (in addition to those standardized under (a) above) to be placed within or near the particular individual's pedigree symbol, to indicate particular traits and their degree of development.

(h) Other minor characteristics of the stardardized chart can be deduced from the study of the "Sample Pedigree Chart" which accompanies this report.

(i) The Pedigree Chart shows family connections, gives the family distribution of the outstanding traits under consideration, and serves as an index to the detailed histories and descriptions of the particular person. (Thus, in the family recorded on the "Sample Pedigree Chart," the reference III-3 would lead to all of the facts recorded in accompanying papers about the propositus.)

The International Eugenics Commission (now called "International Federation of Eugenic Organizations") recommends this uniform system which will be printed in the principal journals on heredity and eugenics of the different countries. We hope that it will be accepted everywhere in order to facilitate scientific communications and the interpretation of pedigree charts by students.

Dr. M. A. Van Herwerden, *Chairman*,
Laboratory of Embryology,
University of Utrecht, Holland.

Dr. H. H. Laughlin,
Eugenics Record Office,
Carnegie Institution of Washington, U. S. A.

Eugenical News.

A Progressive Criminal

Condemned to Live

PHILADELPHIA, July 28.—His request to be sent to the electric chair because he was "beyond reform" having been refused by the court, William M. Moore today began a sentence of three to six years in the eastern State penitentiary for raising checks and obtaining money under false pretenses. Moore told the court he had not been free for more than five months at a time since he was 2 years old.

"You would be doing the community a great favor if you would send me to the electric chair, and I wouldn't mind a bit," said Moore. "I think I would be better off dead. I was reared in a reform school farm. I never learned any trade and I didn't have much schooling with books. All I learned was how to be crooked, and I've been told I'm pretty good at that. The trouble is I have a one-track mind and I can't get away from the things I've been doing.

"My whole life has been one institution after another. It used to be my keenest pleasure to learn a new trick in each jail."

—*Washington Star*, July 28, 1926.

Heredity in Medical Science

WITHOUT much knowledge of the inherited (genotypic) and environmental (paratypic) elements of a given constitution we are likely to be unable satisfactorily to understand the disposition or the non-disposition of the person posesssing that constitution to the development of various disease processes, or to the exhibition of inadequate somatic or psychic responsivity to external stimulation. That is why in medicine investigators are no longer content to study the anatomy, the physiology and the pathology of developed organisms only, extremely important as such studies are, but feel that they must inquire also into the problems of inheritance on the one hand and of growth and development on the other. For in order to under-

stand how living organisms have come to be what they are and why there are such variations in different organisms in their modes of response to apparently identical environmental stimuli genetic and comparative studies are indispensable. It is no accident that one person develops influenza and another does not, that of two persons suffering from typhoid fever one dies and another recovers, that one woman weighs two hundred and fifty pounds and her neighbor of the same age only eighty, that of two boys exposed to the same temptation one yields while the other resists, that of two members of a class one is a gold medallist and the other is "plucked," or that of three young women surrounded by similar emotional stimuli one shows elation, one depression and the third apathy. Medical men, however, are far, as you know, from being able, in every case, as yet to explain these diversities of response. I believe, however, that such divergent modes of reaction will prove to be susceptible of explanation and that as medical science progresses we shall gradually acquire the knowledge that will enable us to predict when, where and how disease will develop, and why some people think, feel and behave adequately and others inadequately. Gradually, too, with the increase in our powers of prediction we shall also see an augmentation of our power to control. During the past century the ability of medical men to predict and to control in the domain in which they work, has, it is true, grown enormously, but all will admit that this growth, gratifying as it is, must be regarded as infinitesimal compared with that to which our profession aspires.

Science, Vol. LXI, No. 1583, May 1, 1925, p. 451.

Interest in Better Livestock Grows

AN increasing sentiment toward the breeding of improved livestock is apparent from frequent reports and inquiries received by the United States Department of Agriculture. These deal particularly with methods by which some localities are introducing purebred sires and rapidly grading up their herds and flocks. The department, acting as a clearing house for such information, is furnishing local officials and stockmen with methods, posters, and educational material.

According to records of the Department of Agriculture, in the last few years 43 counties in the United States have attained the distinction of having 100 or more livestock owners that are using purebred sires exclusively and have adopted breading methods leading to still further improvement.

A Correction

IN Dr. Brozek's paper on "Genetics of the Monkey Flower," in the April issue, an error has been discovered in the legend to the illustration on page 126 (Figure 9). The letters just below the cut should be changed to read: *B* instead of *C*, *A* instead of *B* and *C* instead of *A*. In the first line of the explanation the word *left* is to be changed to read *right*, and in the same line *right hand* changed to read *left hand*.